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ABSTRACT

New instructional procedures for the competency-based curriculum for pharmacy education are examined by educators. The evolution of the competency-based program at the College of Pharmacy at the University of Minnesota is described, and information is presented concerning the classroom instructional model, the development of performance objectives, and the design of a learning sequence and learning packages (Thomas E. Cyrs, Jr.). Attention is also directed to: preparing classroom tests (Paul G. Grussing); evaluating competency-based programs (Richard L. Holloway and C. Angerson Johnson); multi-dimensional assessment procedures (Thomas E. Cyrs, Jr. and Paul G. Grussing); improving oral presentations (David A. Garloff); improving lecture presentation formats through student interaction (Thomas E. Cyrs, Jr.); designing effective visuals (Martin E. Finch); personalized systems of instruction (James G. Henkel); instructional development for a competency-determined curriculum (Constance M. Greco); values education for the health sciences (Michael J. Johnson); an experiment in education--a patient-oriented pharmacy curriculum (Albert I. Wertheimer); and copyrighting one's instructional materials (L. Yvonne Wulff). Steps in the classroom instructional model are: validate professional competencies, specify and sequence learning performance objectives, design classroom testing procedures, identify and select alternative instructional strategies, implement the teaching/learning system, and assess learning outcome. Illustrations and bibliographies are included. (SW)

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Handbook for the Design of Instruction in Pharmacy Education

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INTRODUCTION

This Handbook has been prepared by the staff of the Curriculum Improvement Office and other health sciences personnel to assist you in the exploration of new instructional procedures for the competency-based curriculum. It is hoped that it will aid you in such a way as to make the program effective and practical.

A Handbook of this nature takes many thoughtful and laborious hours to produce. The titles for the chapters were requested by the faculty of the College of Pharmacy. Some are highly practical while others provide a theoretical foundation. As new questions arise relative to instructional methodology, please make them known to our educational staff so that new chapters can be prepared. If you have questions and suggestions for the improvement of existing chapters, please make these known also.

Although written for pharmacy education, a Handbook of this nature can be used in any area of the Health Professions to improve instruction. I hope that as our curriculum unfolds, we will continue to make as significant a contribution to health education as we have in our scientific research.

Lawrence C. Weaver
Dean

PREFACE

This handbook has been prepared to assist you in the design of classroom instruction focused on competencies which form the core of the professional pharmacy curriculum. The individual chapters have been written in response to topics requested by the faculty and provide both rationale and methodology for many instructional procedures. As additional areas of interest are identified by the faculty, new chapters will be added. The purposes of this handbook are threefold:

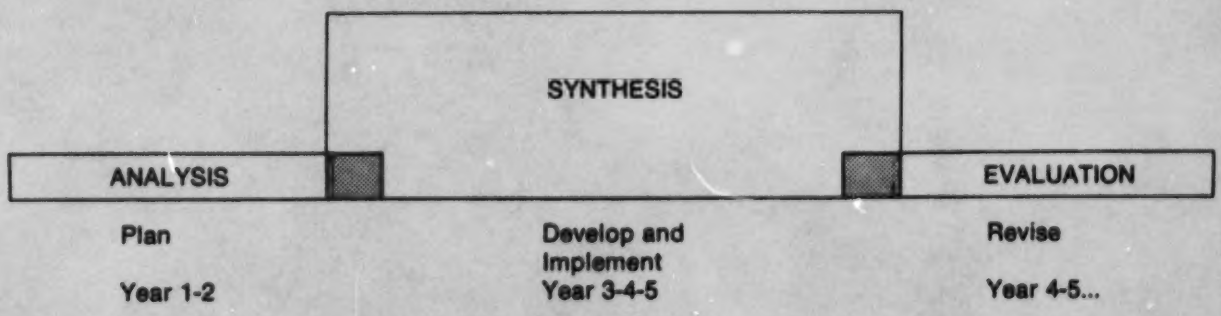
1. To provide needed skills so that faculty, working alone and in collaboration with the Curriculum Improvement Office personnel, can design a variety of instructional strategies to be used during the implementation of the curriculum.
2. To provide essential information on certain instructional procedures prior to further faculty development programs.
3. To provide background information on the essential elements of a competency-determined curriculum in pharmacy.

HOW TO USE THIS HANDBOOK

Review the chapter headings and decide which are most relevant to you. Each chapter provides essential information but is by no means exhaustive. Treat each chapter as a reference. Additional information will be available through the Curriculum Improvement Office. Remember, this handbook is a reference document and is not designed to be self-instructional. If you have any suggestions for improvement or can provide additional or more relevant examples, please contact Tom Cyrs (612-376-4893).

COMPREHENSIVE CURRICULUM ADMINISTRATIVE PLANNING MODEL

Any major effort at curriculum development requires a "game plan" in order to insure some degree of success. There are three major *phases* to the competency-based curriculum effort which can be described as the analysis or planning phase; synthesis or development and implementation phase; and the evaluation or revision phase. As Figure 1 indicates, these are not discrete phases, but overlap considerably. Planning in the later stages will continue as instruction is designed. Students will begin to use the newly designed instructional materials in a variety of alternative instructional procedures. Information gained from these initial tryouts will be used to revise the materials and procedures.



Specific functions needed to design the curriculum were incorporated in each phase of the administrative planning model:

Analysis/Planning Phase

1. Identify, evaluate, validate "must" and "should have" competencies.
2. Analyze competencies to identify supporting performance objectives.
3. Design student assessment procedures.
   a. Develop test item bank.
   b. Develop assessment center.
4. Design computer management information system.
5. Design implementation plan by professional year.
6. Design overall program evaluation plan and procedure.

Synthesis/Development and Implementation Phase

1. Determine implementation phases by professional year.
2. Determine degree and suitability of self-pacing.
3. Determine competency placement within professional years.
4. Assign areas of instruction.
5. Identify alternative modes of instruction.
6. Design instructional materials and reuse based on field-test data.
7. Teach students in first professional year.
8. Utilize assessment procedures.
9. Debug computer management information system.
10. Begin second and third years.

Evaluation/Revision Phase

1. Determine degree of achievement of program goals.
2. Identify level of adaptiveness to student and faculty needs.
3. Determine achievement of professional competencies.
4. Determine nature of future program development.

RELATIONSHIP OF THE PROFESSIONAL COMPETENCIES TO THE OVERALL CURRICULUM DEVELOPMENT EFFORT

The "must have" competencies were derived from statements about the essentials for contemporary competent practice which were elicited directly from faculty, students, practitioners and consumers. These descriptors were then evaluated for current relevancy by the entire faculty, student body (second and third professional years and Pharm.D. I and II) and practitioners. All except two of the competencies were judged to be relevant by *all* who had an opportunity to rate them. Data and observations collected during this period in twenty-eight site visitations (14 individual sites visited twice for a total of 8 hours each) corroborated these findings. Each of these "validated" competencies was then analyzed by faculty to identify the supporting behaviors and subsumed theory and knowledge structure which, if taken collectively, would constitute competency. Each analysis was then reviewed, modified in some cases, and approved by a Professional Review Committee made up of faculty, practitioners, and students. *These data (34 "must have" competencies) are not the curriculum.* These are the skills and knowledge that were judged as absolutely and directly essential to practice in 1976 and without the mastery of which a graduate would not be professionally competent. This is the minimum "core" of the curriculum, a great deal of which already exists. This defines institutional and community practice in 1976, and describes "what is." It makes no value judgment about the relative worth of the competencies.

The second set includes competencies which are *not* commonly found in contemporary practice, but which define "WHAT SHOULD BE" future practice within the next 5 years. These fourteen "should have" competencies were derived from statements of faculty, practitioners, students and consumers about what directions they felt the immediate future of community and institutional practice should take. These statements of future competence are *now* in the process of evaluation for relevancy by being sent to the entire faculty, student body and Minnesota practitioners. The results of this "relevancy rating" should be influential on the evolving curriculum. Both sets of competencies will constitute the *major core* of the curriculum for professional practice and will suggest some additions and modifications. This still *does not* constitute the entire curriculum, but does specify direction for new additions in preparation for practice.

1976 "must have" directly related and essential	+	1976-86 "should have" indirectly related but essential	=	major professional practice core curriculum

Within *both* sets of competencies, there are several perceived issues. What differentiates the technical training program from the professional program? A review of the job analysis data clearly indicates that there are skills which are manipulative and repetitive and require a minimal knowledge base. It would be possible to isolate these mechanical functions and provide *only* the skills and knowledge necessary to perform these discrete technical tasks. However, the analysis indicates that there is a broad range of skills and knowledge which will require intellectual and attitudinal development far surpassing the discrete and isolated functions constituting technical performance. These higher-level elements of the curriculum address the broader problems of "why" and "why not" and go beyond the information and skill necessary to function as a technician. These higher-level skills also will address issues of value, worth and choice amid conflicting requirements of professional practice and will have much further reaching consequences than *today*. Such intellectual development is not essential to technician training.

Another set of intellectual skills and knowledge *not directly related* to the stated competencies is *generally useful* within the total context of practice and social intercourse. The student would benefit from ancillary education in the physical and behavioral sciences and exposure to areas within the liberal arts, engineering, management, economics or other of the health sciences. Here, quantity and election relate more closely to general competence than do quality and requirement.

1976 "must have" competence directly related and essential	+	1976-86 "should have" competence—indirectly related—essential or optional	+	General competence	=	TOTAL Curriculum
Core professional						

The salient differences between the pharmacy technician and professional pharmacist are vision, judgment, responsibility and the ability to view pharmacy within the total health delivery complex and social milieu; this is much more than is expected of the technician. The professional can sort out and deal with the tremendous proliferation of scientific knowledge as it affects practice. He or she can evaluate technological advances and their future impact on pharmacy and can identify in perspective the new role definitions which will result from these advances.

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EXPLANATION OF THE CLASSROOM INSTRUCTIONAL MODEL

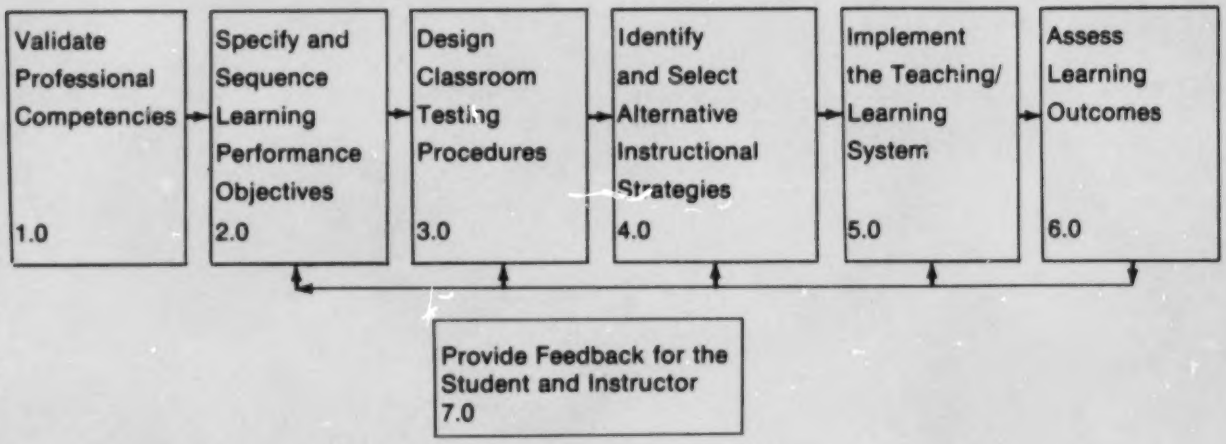
Introduction

The competency-based curriculum at the College of Pharmacy is based on a model of an *instructional system* defined as: an integrated arrangement of equipment, personnel, instructional materials, subject matter from the physical and behavioral sciences, presentation form, learning environments and assessment procedures; these elements function in such a way as to lead the student to the mastery of pre-determined performance objectives which have been derived from validated professional competencies. This model has been designed to present to you a variety of learning systems, some of which are individualized and personalized. A model is a conception of reality at a given time and is subject to change as more empirical data are gathered and experience gained. The classroom instructional model presented in this chapter is a new version of the overall curriculum model. Each rectangle represents a discrete function which contributes to the operation of the entire system. Arrows represent the flow of information from one function to another. This flow exerts a distinct effect on the output of the instructional process.

Should a professional competence be described as a diploma hung on the wall or as those professional attributes one should possess and be judged capable of demonstrating?

STEPS TO DEVELOP EFFECTIVE CLASSROOM INSTRUCTION

The Classroom Instructional Model


Validate Professional Competencies 1.0
Specify and Sequence Learning Performance Objectives 2.0
Design Classroom Testing Procedures 3.0
Identify and Select Alternative Instructional Strategies 4.0
Implement the Teaching/ Learning System 5.0
Assess Learning Outcomes 6.0
Provide Feedback for the Student and Instructor 7.0

STEP 1
Select Validated Professional Competencies

Regardless of the mode of instruction selected, an instructional sequence must be related to a competency, a series of competencies or a grouping of performance objectives supporting a competency. The instructional units' contribution to the competency must be contemplated at all times.

STEP 2
Specify Learning Performance Objectives

All performance objectives are derived from an analysis of the validated professional competencies. These objectives are stated in a precise and measurable form which indicates exactly what the student is *expected to do* after instruction. These objectives should not deal with specific test situations but should specify *a broad range or class of behavior* which can be applied to many different learning situations.

STEP 3
Design Classroom Testing Procedures

Assessment procedures should provide valid and reliable measures of the performance objectives. Besides paper and pencil tests, there should also be measures of actual performance when indicated. These procedures should include pre-testing, self-testing and post-testing of information skills and attitudes, individually and in combination.

STEP 4
Identify and Select Alternative Instructional Strategies

Instructional strategies include any *means of student grouping* (lecture, small group, independent study, peer tutorials) and any *method of information delivery* (media such as film, tape, video, etc.). Selection of the grouping pattern and delivery system should be based on the nature of the behavior called for in the performance objective. For example:

Since it is strongly held that students have different styles of learning, different instructional media should be identified and used whenever possible.

STEP 5
Implement the Teaching/ Learning System

Ideally, any new instructional strategy should be field-tested with a few students in order to identify and eliminate obvious errors. However, most faculty do not have the time or resources for such a field test and implement the entire system at once.

STEP 6
Assess Learning Outcomes

Final assessment indicates to what degree the performance objectives have been mastered using the selected instructional strategies. If the objectives have not been achieved to the determined proficiency level, then a detailed examination of the entire instructional unit should be conducted.

STEP 7
Provide Feedback to the Student and Instructor

Feedback of student progress (as indicated in either self-tests, instructor corrected tests or observation) must be provided frequently so that both the student and the instructor know at all times how well the student is achieving the objectives.

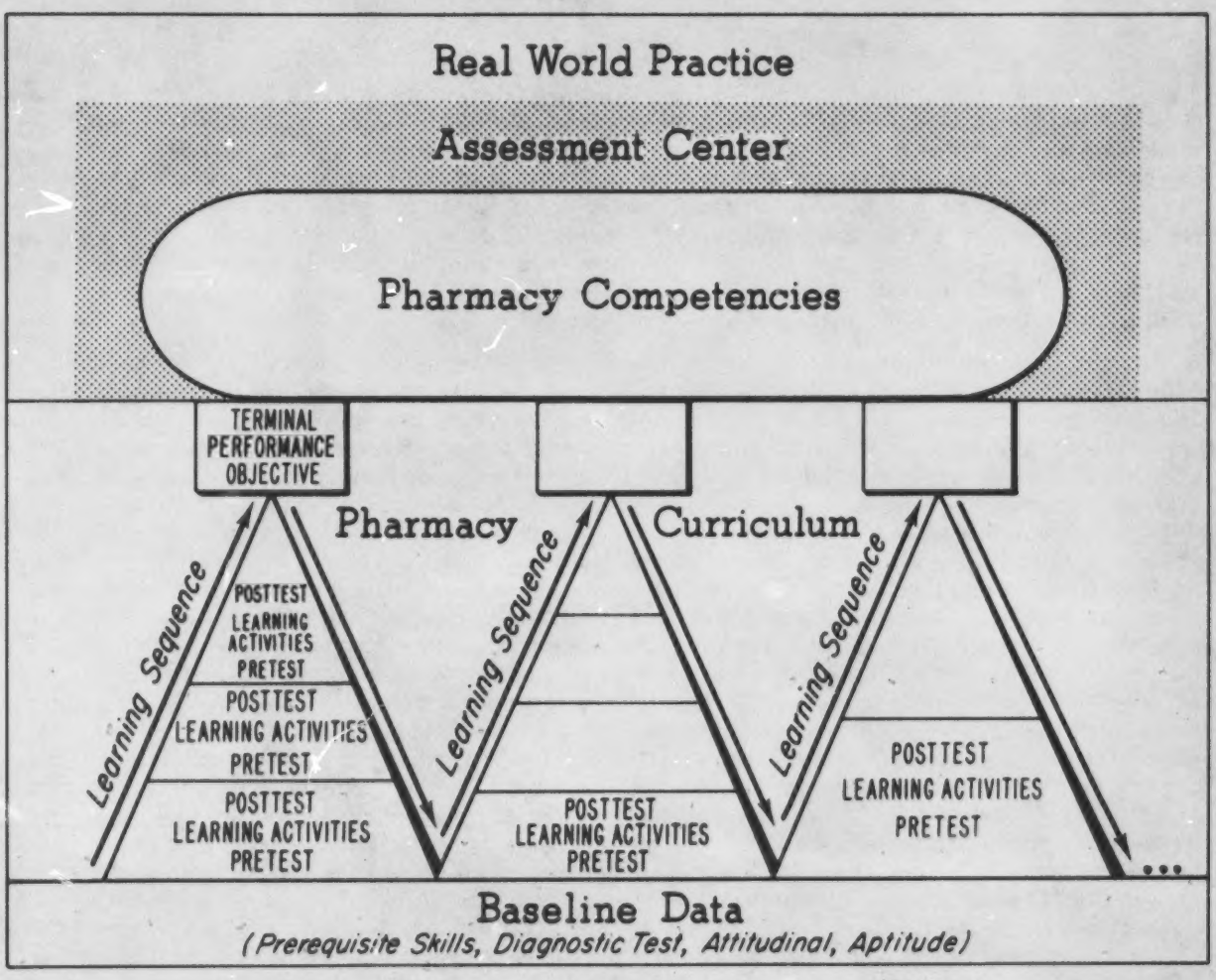
THE EVOLUTION OF A COMPETENCY-DETERMINED CURRICULUM MODEL FOR PHARMACY EDUCATION

Thomas E. Cyrs, Jr.

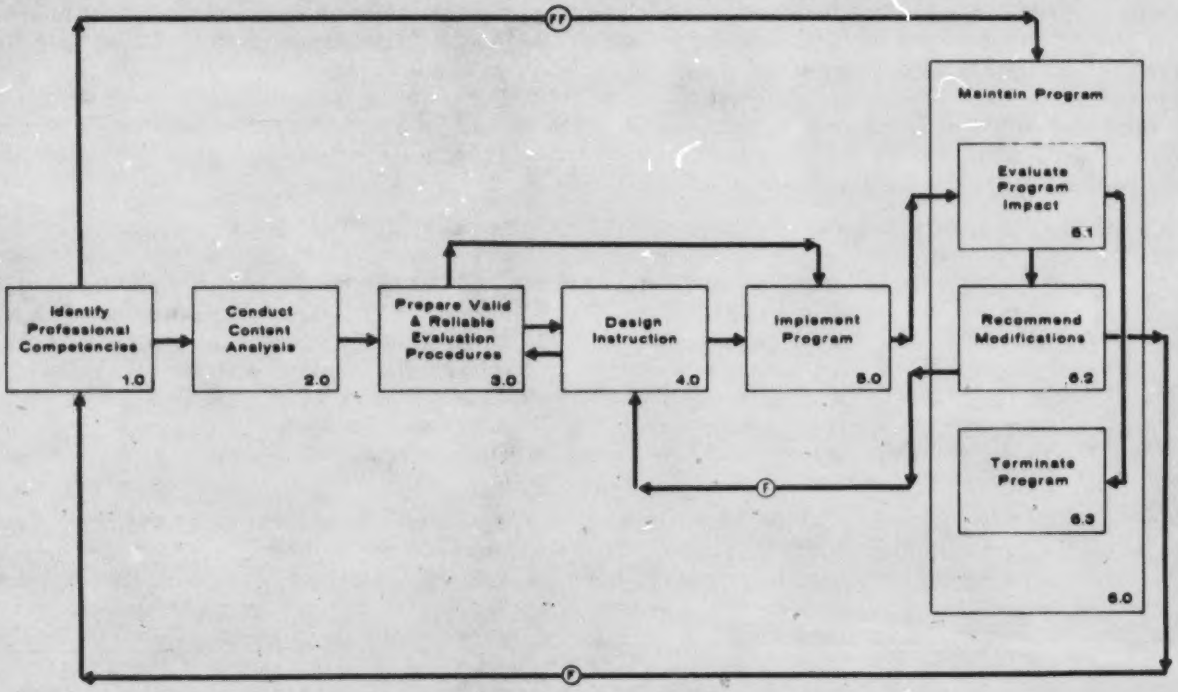
A concern for the improvement of teaching effectiveness led the faculty at the College of Pharmacy at the University of Minnesota to seek outside financial assistance through the Public Health Service. Fortunately, funds were secured for a five year period to design, implement and evaluate a competency-based curriculum. Toward this end, a Curriculum Improvement Office was established at the invitation of the faculty to provide the guidance and expertise necessary to design such a curriculum in collaboration with the faculty. Office staff includes a full-time educational director, a full-time educational measurement specialist and a three-fourths-time pharmacy curriculum specialist. The decision was made to subcontract with outside agencies[1] to provide large pools of expertise for short range preliminary phases of curriculum development rather than build a large internal staff for the first two years of the project.

A review of the literature revealed numerous meanings of the term "competency."[2,3] Most programs in pharmacy and other health science areas have equated a competency with a behavioral objective a la Mager.[4] This definition simply packages old wine in new wineskins. As the concept of a competency-based curriculum was explored, a precise definition of competency became necessary. A *competency,* then, was defined as acquired intellectual, attitudinal and/or motor capabilities[5] derived from a role in a specified setting and stated in terms of a composite of behavior which integrates behavioral objectives and elements of existing behavior.[6] (Figures 1-2) It is this holistic approach[7] to a competency definition which differs significantly from other competency-based programs, since the shift of emphasis is from the process of learning to the results of learning. Once this approach to competency definition has been taken, traditional student evaluation procedures (paper/pencil) can not be used alone. Assessment must be conducted in an environment which simulates the real world setting and role in which the performance is expected to take place, and from which the competency is derived. In fact, this may be the only *valid* way to evaluate competency mastery. This approach is called criterion sampling.[8] It departs from respondent behaviors in which the test designer structures a stimulus situation in advance and then demands specific responses. Although economical in terms of scoring time and overall costs, respondent behavior alone cannot predict any probability of success in the real world of pharmacy where complex problem-solving and judgmental skills are required. Respondent behavior—as defined in discrete behavioral objectives and measured with paper/pencil tests—could satisfy the need for basic knowledge and understanding of concepts, but when application, problem-solving and judgmental behavior are required, other assessment procedures will be necessary. Work sample simulations, derived from pharmacy settings, require synthesis and integration of behavior to solve problems and can complement respondent behavior data. Unless there is congruence between testing and the realities of pharmacy practice, validity and reliability become serious issues,[9] since performance on a test implies a relationship to performance on the job. The most pressing issue becomes one of predictive validity or, how can a student's future performance (competence) be predicted from a knowledge of prior test results?[10] Does the possession of a degree imply predictable competence? Do grades (indicators of the degree of accuracy for respondent behavior) predict success in the real world? How can we certify competence for the purposes of licensure since licensure implies the possession of certain competencies? Does licensure protect us from incompetent practitioners? How can we *predict* competent performance?[11]

Alternative solutions to these and other serious questions became paramount. How could "real world" competencies be identified, evaluated and validated? How could these competencies be validly and reliably assessed, given the proposed definition of competency? How could a curriculum be designed that would address these questions, yet individualize and personalize the curriculum and provide for the changing role of the pharmacist? To put the whole issue into the context of a competency-based curriculum, an overall comprehensive curriculum model was developed as shown in Figure 2. Competencies were identified through the use of carefully screened expert panels consisting of faculty, students, practitioners and consumers of pharmacy services. Goal analysis procedures proposed by Mager were slightly modified and used.[12,13] Two discrete yet closely related sets of competencies needed to be identified. There are the core competen-


Real World Practice
Assessment Center
Pharmacy Competencies
TERMINAL PERFORMANCE OBJECTIVE
Pharmacy Curriculum
Learning Sequence
POSTTEST
LEARNING ACTIVITIES
PRETEST
POSTTEST
LEARNING ACTIVITIES
PRETEST
POSTTEST
LEARNING ACTIVITIES
PRETEST
Learning Sequence
POSTTEST
LEARNING ACTIVITIES
PRETEST
Learning Sequence
POSTTEST
LEARNING ACTIVITIES
PRETEST
...
Baseline Data
(Prerequisite Skills, Diagnostic Test, Attitudinal, Aptitude)

COMPREHENSIVE COMPETENCY-BASED CURRICULUM MODEL



cies which were considered essential to the practice of pharmacy in any setting and were appropriately labeled "must have" competencies. The second set, each of which has recently been identified but not evaluated, consists of those desired competencies which should be incorporated into the practice of pharmacy. These are referred to as "should have" competencies.[14] Prior to meeting for two full workdays, the panelists (six each for community, institutional and general practice) were asked to provide words and short phrases which would describe the core of "must have" competencies. These were reviewed and edited by the College of Pharmacy staff and used as the basis for further analysis and clarification by the panelist groups. The results of these efforts were a list of "must have" competencies. In order to determine the relative importance and value of each competency statement, over 600 practitioners, students and faculty within Minnesota were asked to evaluate the competencies. All except two of the competency statements were highly valued by 93% of the respondents. The job-relatedness of the competencies was determined by two different on-site visitations where trained graduate pharmacy administration students conducted job analyses in 14 different pharmacy settings using the job analysis methodology established by the U.S. Employment Service.[15] The results were compared to the identified and valued competencies; final confirmation and validation were made. The synthesis of these three procedures[16] provides an *empirical* basis for identification of those competencies which, when combined with the "should have" competencies, will determine the overall pharmacy curriculum. We invite you to replicate these procedures in different parts of the country so that the procedures themselves might be validated.[17]

These validated competencies were then analyzed by faculty members in collaboration with graduate education students, subcontractors and the Curriculum Improvement Office staff to identify all *major* content and supporting terminal performance objectives. The result of these content analyses was lists of performance or behavioral objectives in hierarchical relationships. These final content analyses have been reviewed for comprehensiveness and appropriateness by Professional Review Panels consisting of faculty, students, practitioners and consumers of pharmacy services. Any differences or opinion between the primary faculty member conducting the original content analysis and the Professional Review Panel reviewing the analysis will be resolved by the Professional Education Committee which represents the entire faculty in all curriculum matters. The objectives resulting from this content analysis will serve as the foundation for student assessment and the design of instruction.

Since competencies were defined as the synthesis and integration of behavioral objectives, traditional assessment procedures alone could not be used. This was further reinforced by the need for predictive validity of assessment procedures in which the probability of future performance is predicated on past assessment. The problem of preparing students for licensure has further complicated the matter since assessment for licensure has serious legal ramifications.[18,19] Assessment for licensure must be concomitant with the realities of pharmacy practice. A side issue of equal import, but not discussed in this paper, is the question of assessment for re-licensure in order to maintain minimal competency standards for professional practice. A promising approach to solving this problem may be in the use of an Assessment Center method[20,21,22] similar to that used in management to select the best candidates and to predict the highest probable degree of success in the management activity. An Assessment Center is more a methodology or process than a place for assessment. Assessment procedures use work sample simulations in order to assess a student's performance on a single competency or small cluster of competencies. Multiple raters make independent systematic objective observations of problem solving and other behavior in simulated environments relative to the validated competencies.[23] Work sampling techniques useful in measuring competency performance in individual and group exercises include simulations, role playing, gaming and situational problem solving. The overall Assessment Center method intensifies these processes by manipulating circumstances and situations in such a way as to allow the assessors to determine collectively the presence or absence of certain behavioral dimensions through the use of behaviorally anchored rating scales.[24,25] This technique takes a holistic approach to assessment rather than the atomistic approach of paper and pencil testing as the primary means of student evaluation. Through feedback of strengths and weaknesses identified in the intermediate and terminal Assessment Center, the student, in collaboration with faculty members, will be able to determine further educational needs. Thus the Assessment Center approach becomes a diagnostic and prescriptive model for student developmental[26] needs as well as a terminal assessment method to determine the degree to which the competencies have been mastered. The data from the terminal assessment will also identify weaknesses and need for improvement in the curriculum.

Other data collection instruments, including all paper/pencil scores from the criterion tests, will also influence the final assessment. Criterion-referenced tests will be designed to measure specific performance objectives which were derived from an analysis of the competencies. A criterion-referenced test is designed to yield specific information about a student's performance relative to a predetermined criterion or standard. This test's primary purpose is descriptive. It provides an absolute rather than a relative measure of student performance. The question of whether student A can perform as well and as fast as students B and C is replaced by the question, can student A perform this task to the specified level of performance. Mastery of the task within a realistic time becomes paramount rather than partial mastery measured by comparing performance with that of other students. Traditionally, one or two test items were produced to measure each performance objective. If mastery of these test items was demonstrated, then an inference was made that the student's performance would be generalizable and transferable to a whole class or domain of situations even though the class or domain had never been specified. This resulted in the delusion that real "transfer of training" would take place regardless of the triviality of the performance objectives and accompanying test items. This problem of test item development for generalizability and transferability has been addressed by the ongoing development of a domain-referenced test item bank. Domains or general classes of behavior[27] have been identified through the competency statements, and will allow us to identify a number (10) of different test items for each terminal performance objective which supports the competency statement. The average competency contains four or five terminal objectives. Thus, there will be at least 40-50 test items generated for each competency outcome. Since most performance objectives don't provide adequate cues (stimulus requirements and range of response modes) for test development, test item forms[28] are being developed for each terminal objective to facilitate better and more accurate test item design by faculty and practitioners working with us. Specific tests, each of comparable difficulty and validity for a competency, will be randomly selected from this pool of items. Through the use of domains of behavior, the probability of skill transfer is significantly increased.

One of the most significant problems that will be faced by the project staff and faculty deals with accurate and acceptable levels of test proficiency: what criteria should be used to determine cut-off scores (difference between mastery and non-mastery scores) in criterion testing? What, exactly, constitutes mastery for a competency? Answers to these questions have not been determined at this time. Several authors and researchers who are presently influencing the project staff on these issues include: John Meskauskas of the American Board of Internal Medicine, who has reviewed the current procedures suggested for setting the pass-fail scores as well as varying concepts of mastery;[29] and Jason Millman of Cornell University,[30] who has addressed the effect of non-mastery upon future learning:

> "If, on the basis of a logical analysis of the subject matter and the extant instructional system, the knowledges and skills are seen as fundamental or prerequisite to future learning, then a high proficiency level is required. A lower passing score can be tolerated when the material is not seen as completing a necessary link in the development of some more complex concept or skill, especially if the ideas will be covered again in the curriculum."[31]

True cut-off score, or level-of-functioning as Millman refers to the concept, has been defined as the percent of items a student would be able to answer correctly if tested on the entire universe or domain of test items. Millman has worked out some interesting statistical tables for determining specific numbers of test items for domain generalizability.[32]

The design of instruction will commence during the month of January 1977 and will continue throughout the duration of the project. Although a significant portion of the curriculum will be modularized in some fashion, some traditional teaching methods will continue as long as they address the competencies. A learning module has been defined as:

> ". . . a self-contained set of teaching-learning materials in any form. Completion time varies from a few hours to a few weeks. It is pre-designed as a classroom management strategy to help the student achieve specified didactic or clinical performance objectives. It is self-directing and self-correcting and provides for a wide variety of learning styles by incorporating a range of commercial10 available or locally produced multi-media instructional materials. The module allows the student to pace at his own speed so that learning progress is known to both student and instructor at all times and is based on measured understanding."[33]

This concept incorporates all forms of self-paced curriculum programs including personalized systems of instruction,[34] audio-tutorial approaches and computer-assisted instruction. The issue that will have to be resolved prior to the implementation of the entire curriculum (September 1978) is the degree to which self-pacing should be allowed. Some questions to be addressed include:

- Should students be allowed an indefinite amount of time to complete the prescribed learning sequence?
- Should definite time parameters for completion of learning sequences be established?
- How will time parameters be established and by whom?
- How many times will a student be allowed to re-cycle through a given learning sequence to demonstrate mastery?
- If some latitude in time is allowed, how will this affect scheduling for both student and instructor?
- How much structure should be provided for the less motivated student and the poorer achieving student in a self-paced program?

These questions only begin to speak to the essential issues in a competency-based curriculum and are not meant to be exhaustive. By posing these questions in this paper, alternative solutions can be sought prior to program implementation, and provide some degree of management structure to identify alternative solutions compatible with faculty desires.

Curriculum implementation will begin on a *pilot* basis with *some* students in September 1977. A Curriculum Management Information System is currently under development which will aid the faculty in monitoring student progress. Problems to be solved prior to full program implementation (September 1978) include:

- Student-faculty flexible scheduling
- Grade reporting procedures
- Space requirements
- Student counseling needs
- Examination of the course credit system
- Additional administrative needs (management by objectives)
- Faculty reward system (tenure and promotion) as it relates to the design, implementation and maintenance of a competency-based curriculum
- Evaluation concerns of faculty. How will the total impact of the new curriculum be evaluated?

The most significant question to be answered is, "will a competency-based curriculum produce a more proficient practitioner?" A competency-based curriculum which addresses the questions posed in this paper does not exist, to the best knowledge of the College of Pharmacy, although the individual components for designing such a program have existed for some time. The answer, at this time, can only be based on reasoned conjecture and limited experience. If by "proficient" we mean that it is possible to determine *empirically* what a pharmacy practitioner is *to do* in the environment for which he has been trained to practice and if we are able to state with a degree of *certitude* that the pharmacy practitioner will, in fact, function as specified, then a competency-based curriculum has a high degree of probability of producing "proficient" practitioners.

The Curriculum Improvement Office, working at the invitation of and under the direction of the faculty, will incorporate the most empirically proven procedures tempered by pragmatic considerations of current educational research.

FOOTNOTES

[1]Minnesota Systems Research, Inc., Minneapolis and Personnel Decisions, Inc., Minneapolis.

[2]Trivett, David A. *Competency Programs in Higher Education*. Washington, D.C.: American Association for Higher Education, 1975, pp. 9-10.

[3]Burns, Richard and Klingstedt, Joe Lars (eds.). *Competency-Based Education*. Englewood Cliffs, New Jersey: Educational Technology Publications, 1973, pp. 7-10.

[4]Mager, Robert. *Preparing Instructional Objectives*. California: Fearon Publishers, 1962.

[5]Gagne, Robert and Briggs, Leslie J. *Principles of Instructional Design*. New York: Holt, Rinehart and Winston, Inc., 1974, p. 25.

[6]Meeth, Richard L. "The Characteristics of Competency-Based Curricula." *Regional Spotlighting*. Speech to the Southern Regional Educational Board Conference on Competency-Based Curricula in General Undergraduate Education. (Sept. 1974), pp. 2-3.

[7]Hall, Gene E. and Jones, Howard L. *Competency-Based Education—A Process for the Improvement of Education*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976, pp. 29-30.

[8]McClelland, David C. "Testing for Competence Rather Than for 'Intelligence.'" *American Psychologist*. January 1973, p. 7.

[9]White, Willo P. "Testing and Equal Opportunity." *Civil Rights Digest*. (Spring, 1975), p. 48.

[10]American Psychological Association. *Standards for Educational and Psychological Tests*. Washington, D.C.: AMA, Inc., 1974, pp. 25-55.

[11]Huff, Sheila. "Education, Work, and Competence." *Society*. January/ February, 1976, p. 47.

[12]Mager, Robert. *Goal Analysis*. California: Fearon Publishers, 1972.

[13]Cyrs, Thomas E., Dobbert, Daniel J., and Grussing, Paul G. Progress Report -Phase I: *Competency Identification Including Evaluation and Validation*. Minneapolis: College of Pharmacy, University of Minnesota, 1976.

[14]The "should have" competencies will follow the same procedures used to identify and evaluate the "must have" competencies; however, since many of the "should have" competencies are desirable but not necessarily in practice, validation will not be possible at this time.

[15]United States Employment Service (Bureau of Employment Security). *Training and Reference Manual for Job Analysis*. Washington, D. C.: U.S. Government Printing Office.

[16]The idea to synthesize and integrate these procedures took place prior to the establishment of the Curriculum Improvement Office under the direction of Dr.Daniel J.Dobbert, who is now a member of the Office.

[17]The specific procedures, identified competencies and overall statistics are available from the Curriculum Improvement Office. See footnote 13.

[18]*Uniform Guidelines on Employee Selection Procedures*. Office of the Deputy Attorney General. Harold R. Tyler, Jr., Deputy Attorney General and Chairman, E.E.O. Coordinating Council, Washington, D.C., December 1975 (pre-publication).

[19]Huff, p. 47.

[20]Kraut, Allen I. "A Hard Look at Management Assessment Centers and Their Future." *Personnel Journal*. May, 1972, pp. 317-326.

[21]MacKinnon, Donald W. *An Overview of Assessment Centers*. Greensboro, N.C.: Center for Creative Leadership, 1975.

[22]Howard, Ann. "An Assessment of Assessment Centers." *Academy of Management Journal*. March, 1976, pp. 115-134.

[23]Hinrichs, John R. and Haanpera, Seppo. "Reliability of Measurement in Situational Exercises: An Assessment of the Assessment Center Method." *Personnel Psychology*. Vol. 29, pp. 31-40.

[24]Campbell, V.P., Dunnette, M.E., Arvey, R.D., and Hellervik, L.N. "The Development and Evaluation of Behaviorally-based Rating Scales." *Journal of Applied Psychology*. Vol. 57(1), 1973, pp. 15-22.

[25]Schwab, Donald P. and Heneman, Herbert G. "Behaviorally Anchored Rating Scales: A Review of the Literature." *Personnel Psychology*. Vol. 28, 1975, pp. 549-562.

[26]Byham, William C. "The Use of Assessment Centers in Management Development." In Taylor, Bernard and Lippitt, Gordon L. *Management Development and Training Handbook*. New York: McGraw-Hill Book Company, 1975, pp. 83-84.

[27]Hively, Wells (ed.). *Domain-Referenced Testing*. Englewood Cliffs, New Jersey: Educational Technology Publications, 1974.

[28]Popham, James. "Essentials of Criterion-Referenced Measurement for Educational Evaluation." An American Educational Research Association Presentation, San Francisco, April 19, 1976, pp. 9-16. (Excellent bibliography provided for all aspects of criterion-referenced measurement).

[29]Meskauskas, John A. "Evaluation Models for Criterion-Referenced Testing: Views Regarding Mastery and Standard Setting." *Review of Educational Research*. (Winter 1976), pp. 133-158.

[30]Millman, Jason. "Passing Scores and Test Lengths for Domain-Referenced Measures." Los Angeles, California: The Instructional Objectives Exchange, Technical Paper No. 7, 1972.

[31]*Ibid*., p. 5.

[32]Millman, Jason. "Tables for Determining Number of Items Needed on Domain-Referenced Tests and Number of Students to be Tested." Los Angeles, California: Instructional Objectives Exchange, Technical Paper No. 6, April, 1972.

[33]Cyrs, Thomas E. "Modular Approach to Curriculum Design Using the Systems Approach." *Instructional Media and Technology*. Phillip Sleeman and D.M. Rockwell (eds.), Pennsylvania: Halstead Press, 1976, p. 117.

[34]Keller, Fred. "Good bye Teacher." *Journal of Applied Behavior Analysis*. No. 1 (Spring, 1968), 1, pp. 79-89.

CONSTRUCTING WORTHWHILE PERFORMANCE OBJECTIVES

Thomas E. Cyrs, Jr.

HOW THIS CHAPTER HAS BEEN PREPARED:

This chapter has been prepared using a technique called Information Mapping* which presents all concepts, definitions, examples, non-examples, and commentary in units called Information Blocks. Maps also use marginal labels for quick reference; cuing such as *underscoring* of words for emphasis, arrows and blocks to offset ideas.

OVERALL OBJECTIVES OF PHARMACY EDUCATION

"THE OVERALL OBJECTIVES OF PHARMACY EDUCATION ARE TO PREPARE PERSONS WITH A READY KNOWLEDGE OF ALL ASPECTS OF DRUGS, THEIR ACTIONS UPON AND USES BY PATIENTS, SO THAT GRADUATES MAY POSSESS COMPETENCIES TO SERVE INDIVIDUAL AND SOCIETAL DRUG NEEDS."

***Pharmacists for the Future*, The Report of the Study Commission on Pharmacy, (p. 108).**

- **How will these objectives and competencies be assessed?**
- **What evidence will we accept that they have been achieved?**

* Horn, Robert E. *How to Write Information Mapping*. Lexington, Mass.: Information Resources, Inc., 1976.

* Horn, Robert E., Elizabeth Nicol, and Joel C. Kleinman, et al. *Information Mapping for Learning and Reference*. Mass.: U.S. Air Force, Command Contract No. F19628-68-C-0212.

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PERFORMANCE OBJECTIVES

INTRODUCTION

Organization and Planning are the cornerstones of good instruction and include the sequencing of the subject matter as well as arranging the conditions under which students will learn. Procedures which aid in the organization and planning of the subject matter will facilitate learning. Providing the students with a *preview of what to expect* helps them to put their efforts into a useful perspective and serves as a framework for the later *application* of what is learned to other units and to professional practice. Objectives, which describe the desired result, provide the student with information about what to anticipate and provide a means of organizing and focusing current effort toward these desirable ends.

INSTRUCTIONAL PLANNING

Instructional planning has traditionally dealt with the form by which the instruction would be delivered to the student. Emphasis has been placed on what the *instructor would do* to orchestrate the class time and *how* the student would be taught. Little consideration has been given to *what* the *student* would be expected to accomplish as a result of having been exposed to the instruction. When this exposure takes place and the student interacts with the instruction, he will be changed in some way. Objectives describe these desirable changes toward which the instruction should be directed. If these objectives are present, the changes in the student must be evident. Objectives which describe what the student is to do or perform are called *performance objectives*. These objectives were earlier referred to as behavioral objectives which implied a behaviorist philosophy. Many instructors who do not espouse behaviorism prefer the term performance objectives, since performance can be equated with behavior.

MEANS-ENDS

Performance objectives provide an organizational and planning method for clearly distinguishing between the *means of instruction* and the *planned ends* which the instruction is meant to accomplish.

ABBREVIATED DEFINITION OF PERFORMANCE OBJECTIVE

A performance objective is a *description* of an *anticipated change* in the *behavior* of a student after exposure to instruction. It is the outcome of instruction that is measurable rather than the process itself.

> THE *PRIMARY PURPOSE* OF A PERFORMANCE OBJECTIVE IS TO COMMUNICATE PRECISE INFORMATION TO THOSE INDIVIDUALS WHO NEED TO KNOW—STUDENTS, INSTRUCTORS AND ADMINISTRATORS.

EXPANDED DEFINITION OF PERFORMANCE OBJECTIVE

A *performance objective* is a descriptive statement of a *class or range of learning outcomes* derived from a *validated professional competency* which lead to a prescribed level of achievement in that competency. The performance called for in the objective must be stated in a measurable, action-oriented form. The described result must be either directly observable or an intellectual or attitudinal capability which can be inferred from the observation. The desired outcome will result from some type of didactic, laboratory, or clinical *instructional effort* and will be demonstrated as an observable change in the behavior of the student as demonstrated in newly acquired skills and attitudes as well as expansion of his informational data base.

EXAMPLES OF PERFORMANCE OBJECTIVES FROM A VARIETY OF HEALTH SCIENCE DISCIPLINES

*Evaluates assay and production control data (lot analysis) and compares them with compended standards.

*Recognizes common *in vitro* tests and distinguishes them from *in vivo* tests used in bioequivalence studies.

*Applies principles of group problem-solving or interaction.

*Designs storage procedures and facilities.

*Given 20 prescriptions containing a variety of errors, the student will identify 100% of the errors and suggest corrections.

*Using any PA chart radiograph of an ambulatory patient, the student will explain why the radiograph is an acceptable one, using the criteria provided in class.

*Given five unknown blood samples, the student will determine with 100% accuracy the ABO grouping and the Rh typing. Both slide and test type methods can be used.

*Given patient data in a case study form, the student will identify and classify any of the four listed possible factors which can elevate or decrease the B.U.N. present in the case.

*Upon request, the pharmacist will provide written objective evidence of his drug product choice to interested physicians and patients.

NOTE: EACH PERFORMANCE OBJECTIVE DEALS WITH A WHOLE CLASS OF BEHAVIOR FROM WHICH NUMEROUS EXAMPLES COULD BE DERIVED FOR TEACHING AND TESTING.

NON-EXAMPLES

*Lists the general rules given during the lecture for role playing episodes in a class.
*States that the neuron is now viewed as the basic unit of the nervous system.
*Defines "simulation game" and explains the components of a simulation.

NOTE: EACH OF THESE "OBJECTIVES" REQUIRES A SPECIFIC RESPONSE AND DOES NOT DEAL WITH A CLASS OR RANGE OF BEHAVIOR. THESE "OBJECTIVES" ARE REALLY SPECIFIC TEST ITEMS. THIS ULTRASPECIFICITY DOES NOT NECESSARILY MEAN UTILITY.

RATIONALE FOR EXAMPLES

Each example indicates that a *class of behavior or skills* is addressed rather than a *specific instance* of behavior or skill. Mastery of one example or test would not satisfy the requirements of the objective, since alternative examples could be used.

SYNONYMOUS TERMS FOR PERFORMANCE OBJECTIVES

Behavioral objectives; performance objectives; learning objectives; instructional objectives; student outcomes; results; expectations; operational definitions; intents; testable objectives.

EXPANSION OF ITALICIZED TERMS USED TO DEFINE A PERFORMANCE OBJECTIVE

PERFORMANCE

Performance is equated with behavior which is defined as any visible activity displayed by a student or inference about a capability made from that activity. Performance implies action and includes attitudinal as well as intellectual and manual skills.

EXAMPLES OF DIRECTLY OBSERVABLE BEHAVIOR:

- *Writing
- *Palpitating
- *Measuring
- *Changes in Temperature
- *Changes in Blood Pressure
- *Extra-occular movements

INFERRED CAPABILITIES FROM OBSERVED BEHAVIOR:

- *Personal warmth
- *Computational Skill
- *Problem-solving
- *Ethical behavior
- *Body Language
- *Intonation

CLASS OR RANGE OF LEARNING OUTCOMES

Worthwhile performance objectives deal with a *class or range* of learning outcomes rather than *specific instances* of behavior or content; and thus provide for a range of parallel learning situations and assessment possibilities.

VALIDATED PROFESSIONAL COMPETENCY

Performance objectives should be derived from professional competencies in the real world of pharmacy practice and then validated in terms of their relevance to that practice. Objectives should clearly support a known competency.

EXAMPLES OF VALIDATED COMPETENCIES

*Performs drug control, storage and drug security functions in drug distribution.

*Evaluates over-the-counter drug products.

*Evaluates the relative therapeutic worth of medical-surgical devices and supplies.

Provides poison control and treatment information.

INSTRUCTIONAL EFFORT

Instruction includes any or all of the following three types of *interactions* both formally and informally:

- *Instructor (pharmacist, M.D., nurse, physical therapist) ⟶ student (as in lectures or tutorials)
- *Student ⟶ student (as in *peer* tutoring and *peer* evaluation)
- *Student ⟶ instructional media (as in programmed textbooks; film; television; or computer assisted instruction)
- *Patient ⟶ student (giving medication history and drug related side effects)

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*Curriculum Improvement Office. *Progress Report: Phase I, Competency Identification Including Evaluation and Validation.* Minneapolis: College of Pharmacy, 1976.

DERIVATION OF PERFORMANCE OBJECTIVES

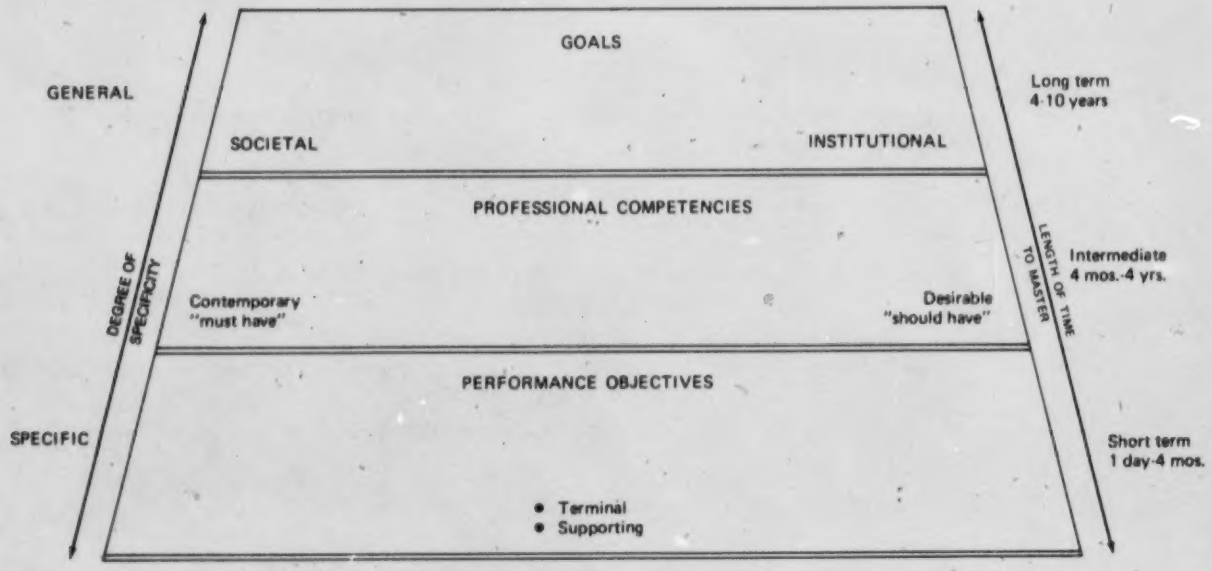
INTRODUCTION

Professional competencies must support and be in concert with the societal and institutional goals from which they are derived. Competencies, once analyzed for their behavioral structure and supporting content, provide the substance for the specification of performance objectives. The relevance and validity of the performance objectives will be determined by the degree to which they can be demonstrated to support the competency.

RELATIONSHIP TO COMPETENCIES AND GOALS

Goals, competencies, and performance objectives should be viewed in a pyramidical structure with goals as the most generally conceived long term expectations; competencies as more specific and encompassing intermediate expectations; and performance objectives as specific short-term expectations.

RELATIONSHIP OF GOALS, PROFESSIONAL COMPETENCIES AND PERFORMANCE OBJECTIVES



EXAMPLES

Societal Goals (4-10 years)

1. Broaden and improve the health care delivery system for a larger segment of society and reduce the cost to the consumer.
2. Reduce the number of hospital admissions secondary to inappropriate drug use.
3. Improve society's ability to utilize medication appropriately.
4. Maximize the benefit:cost ratio for drug therapy.

Professional Competency (4 mos.-4 yrs.) for competency #3

Consults with patients on the selection, use and effects of OTC drugs.

Performance Objectives (representative examples) (1 day-4 mos.)

1. Cautions and advises patient in the use of OTC drug.
2. Determines whether to recommend or dissuade OTC self-medication or refer patient to another health professional.
3. Determines why a patient needs or wants to self-medicate.

DELINEATING SOCIETAL AND INSTITUTIONAL GOALS

Developing Goals

Everything that exists has a purpose within the overall scheme of nature. Societies exist as a natural function of man to pursue goals either imposed or mutually agreed upon. Institutions function to further the goals of a society or to delineate and/or modify the goals which society should pursue.

The *goals* which societies and institutions establish are broadly conceived, *long term* expectations which are *visionary* in nature and provide overall direction for human activity. Goal establishment is influenced by politics, tradition, economics and religion; it provides the *philosophical umbrella* under which the society and institutions will exist and the directions in which they will change. Since goals are broadly conceived and provide only a general direction for plans of action over long periods of time (4-10 years), there is a need to *reduce the ambiguity* of their intent when plans are made to implement them. This leads to the development of professional competencies and final clarification in the performance objectives, which, when viewed collectively, indicate levels of competence.

RELATIONSHIP OF COMPETENCY TO PERFORMANCE OBJECTIVES

Competence or a state of competence is a hypothetical construct that exists as an *internal state* acquired or learned by an individual. It is an *abstract concept* such as an aptitude or state of intelligence. The potential for exhibiting competence exists if an individual has been exposed to the right conditions: school, training, and experience; but the *actualization* of this potential can only be observed in *given situations* where the person demonstrates a specific level of performance. In this respect *a state of competence is situationally determined* by the act performed at a given time and under given conditions. A level of competence will be described by the consistency and accuracy of the performances under parallel conditions.

The specific performance objectives which make up the competency, and the individual tasks (smallest unit of behavior such as: type a label; count tablets; add a column) associated with the objectives, can be learned separately and discretely and may be consistently demonstrated to be correct. However, as performance conditions vary, it can be shown that a discrete performance task (as described in an objective) can be correct under one set of conditions, yet dangerous under another set of conditions. An example of this is:

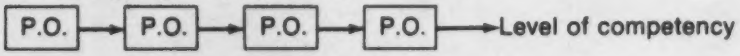
Performance objective: The pharmacist will design an appropriate drug regimen (dose, and interval) for a given disease.
Two conditions: 1. normal renal function
2. renal disease

A state of competence exists when a person makes a judgment about the variables observed in a given situation, determines alternative possible performances, weighs each performance task in light of the known variables and their probable impact, selects the most appropriate performance tasks, and performs the necessary procedures. The *level of competence* will be determined by the consistent results obtained as judged by peers. It is the collective impact of the additive and interactive qualities of these individual performance tasks which will determine when a person is competent.

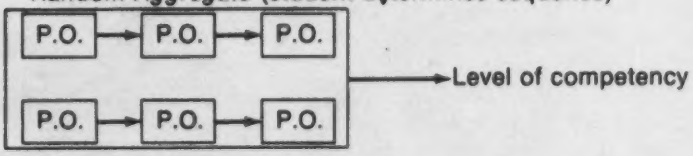
A student might memorize the drug of choice and usual dose of that drug for patients with pseudomomas pneumonia. If Gentamycin were selected, the patient had renal disease, and the pharmacist failed to inquire about the possibility of renal disease, the accumulated drug could cause nephrotoxicity.

A COMPETENCY≠A SINGLE PERFORMANCE OBJECTIVE (P.O.)
A COMPETENCY=AN AGGREGATE OF PERFORMANCE OBJECTIVES (P.O.) AND RELATED TASKS

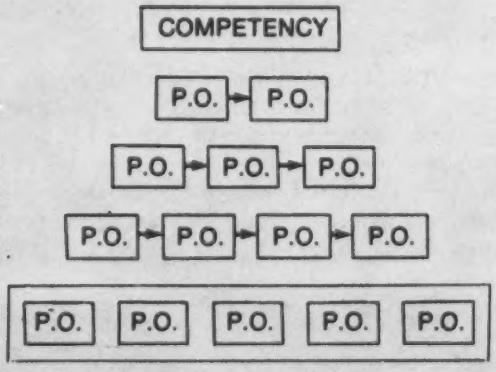
**Linear Aggregate* (sequential)



**Random Aggregate* (student determines sequence)



**Hierarchical Aggregate* (combination of linear and/or random aggregates)



PERFORMANCE OBJECTIVES ARE NOT:

STATEMENTS OF TEACHING METHODS

Teaching methodology deals with the *delivery system* or the *process* by which the student will be exposed to the subject matter. What the instructor does is crucial to learning outcomes. However, learning objectives must be stated in terms of what we want the *student* to accomplish—not the instructor (although instructor performance objectives determine the boundaries of the delivery system). Teaching methods are chosen based on the student behavior prescribed in the learning objectives.

Examples of Teaching Methods:

- *Prepare a lecture.
- *Demonstrate an experiment.
- *Write performance objectives.
- *Select a film for the class.

LEARNING ACTIVITIES

Learning activities such as viewing films or attending lectures describe the *conditions or circumstances* chosen by the instructor under which the student will be expected to master the objectives. These activities are the *means* (controlled by the selected teaching methods) which will be used by the student to accomplish the performance objectives.

INSTRUCTIONAL MEDIA

Instructional media such as audio tapes, filmstrips, 35 mm slides or video tapes describe the *means* by which the instructor has chosen to *present* the subject matter. The media are the presentation form for delivering the subject matter and as such should be considered a *means*.

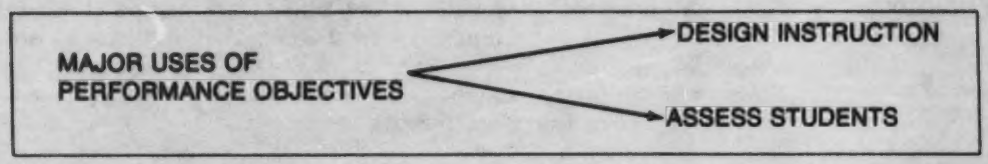
GOAL OR COMPETENCY STATEMENTS SUMMARY

Objectives are measurable *refinements* of the competency statements and are derived from and support them.

MEANS		ENDS
Learning activities	lead to and limited by →	learning objectives
How one is to learn	leads to →	what is to be learned.
Teaching strategies	lead to →	learning outcomes.

USES OF PERFORMANCE OBJECTIVES

MAJOR USES



IN DESIGNING INSTRUCTION PERFORMANCE OBJECTIVES

- *Make learning outcomes more visible and understandable to students and instructors.
- *Provide for instructional decision making prior to, during and after instruction.
- *Make more efficient communications among professional staff and students.
- *Provide a basis for selection of relevant content pools.
- *Provide a means to select media for instruction.
- *Provide for planned change toward individualized and personalized curriculum development.
- *Ensure that sequences of objectives lead to professional competency.
- *Help to determine if the student is making sufficient progress.

IN ASSESSING STUDENT'S PERFORMANCE OBJECTIVES

- *Provide a basis for increased clinical and didactic accountability.
- *Provide for better and more valid didactic and clinical evaluation.
- *Design test pools which provide a measure of student performance as required in the performance objectives.
- *Use test data as a means to redesign instruction.
- *Provide a means whereby student progress is based on measured understanding.
- *Determine whether assessment should be based on paper and pencil or performance measures.

MISCONCEPTIONS ABOUT SPECIFYING PERFORMANCE OBJECTIVES

TIME CONSUMING	Performance objectives take time to generate. Only those objectives that are important and critical to professional practice should be worthy of specification. Specificity of intent does not automatically mean that the objective is useable and worthwhile. It is more important to specify a few critical objectives than dozens having questionable scope, worth and relevance.
NEED FOR IMPROVEMENT	Objectives can always be improved, particularly if they have been derived from competency statements. As the instructor gains more experience and confidence, many objectives may have to be changed to specify more clearly the intent of the instruction which is necessary to attain competency.
TEST ITEM SPECIFICITY	Too many existing performance objectives are nothing more than specific test items where the objective and the test item read exactly the same. This will result in hundreds of objectives for each course or unit and will result in instructor frustration. Objectives should deal with general content which can be assessed with a range of possible test items.
TEST ITEM VALIDITY	Test items or performance situations which have been selected to assess student performance must meet the requirements of the objectives. Too frequently, the objective calls for the understanding of a specific skill, and the test requires the student to analyze or evaluate a specific situation. The individual objectives must be assessed by the test item.
RELEVANCE TO A COMPETENCY	Too many objectives are dictated by convention and have little relevance to practice competencies. They are derived from existing courses and may not relate to professional practice. Since the objectives support and lead to competence, the competencies must be derived from and support professional practice now and in the future.
RIGID INTERPRETATION	There are many variations of objective writing which differ from the original prescription of Mager.* Too often, these formulas call for the generation of test items rather than a broad range of behavior which encompasses these test specific behaviors. Given . . . the student will . . . at XYZ% accuracy.
COMPETENCY= PERFORMANCE OBJECTIVE	*DOES A COMPETENCY EQUAL A PERFORMANCE OBJECTIVE? NO!* A competency is a *composite* or *aggregate* of different performance objectives and is derived from professional practice. The ability to function competently depends on an *integration* of intellectual background, overall attitude and performance skill.
STATIC COMPETENCIES AND PERFORMANCE OBJECTIVES	The knowledge base, attitudes and skills that support professional practice are constantly changing and expanding. In order to *update* the curriculum and prevent it from becoming an *historical document* (always rooted in the past), a process for *continuous review*, deletion, modification and expansion must be designed for all competencies and objectives. Some competencies identified in 1977 for future practice will at some point in time be required for contemporary practice.

*Mager, Robert F. *Preparing Instructional Objectives*. California: Fearon Publishers, 1962. (Revised, 1973).

PREREQUISITES TO OBJECTIVE WRITING

INTRODUCTION

Instructors have used some form of objective writing most of their careers. In fact, the concept of objective writing was first mentioned by Franklin Bobbit in his book entitled *How to Make a Curriculum* published in 1924. However, a more formal and precise manner of objective writing in terms of student outcomes is a recent development. A review of some of your past activities will reveal many of the performance objectives which have guided your efforts.

WHAT ARE THE BIG QUESTIONS?

Ask yourself what it is that you expect the students to accomplish at the end of a course, unit or lecture. What are the big questions that you expect should be answered? These questions can be easily translated into objective form to guide the development of your instruction and help you in developing your testing procedures.

REVIEW PAST TESTS AND EXAMS

Since instructors evaluate those things they consider important, review your past tests and exams. These items will probably identify the most critical aspects of your course. It is possible to "back up" from these questions and identify the class of behavior that the test is designed to assess. If the objective and the test item read exactly the same (or would with slight modifications), you should ask yourself *if the point is really worth your time testing.*

Test Item—Which of the following phenothiazine structures are likely to have anti-emetic activity?
Inferred Objective—The student will predict the pharmacologic activity when given the chemical structure of a compound.

Test Item—From the data listed below, which of these two salts are more completely absorbed:
Inferred Objective—The student will determine the bioavailability of a drug when given blood level-time course data.

Examine the objective closely. Note that the test item may not exhaust the range of possibilities for testing. Alternative tests could be constructed which would assess the student's capability just as well as the chosen test situation. Since the purpose of teaching and testing is to determine the student's ability to *generalize or transfer* his skill to an unknown situation, this type of objective would be of more value than those objectives which are nothing more than specific test items. Collections of parallel test items from which individual items could be randomly selected would be of more value than test specific objectives. Every instructor must decide the number of instances that the student will have to be judged as correct in a test before he will be judged competent.

CONDUCT A CONTENT ANALYSIS

Given the professional competency, analyze the supporting content and outline the important concepts, skills, principles and procedures necessary for the student to master in order to attain the competency. These data can then be translated into performance objectives. The final outline should be reviewed by your peers, practitioners and students to ensure that it is complete and appropriate.

PERFORM A JOB ANALYSIS

A job analysis entails "on-site" observations of pharmacists in community and institutional settings and the recording of all professional activity. Different observers work at different times. The observations are edited and compared to ensure inter-observer reliability. These data are then translated into performance objectives. The objectives should lead to competency achievement which is directly related to the requirements for professional practice. This technique is almost impossible for a single instructor to accomplish without some assistance. The next best alternative would be to bring groups of practitioners together and have them describe their professional activities as they relate to specific competencies. In the absence of either of these procedures, expert consensus among qualified faculty would guard against personal bias.

COMPONENTS OF PERFORMANCE OBJECTIVES

INTRODUCTION

Performance objectives are distinct from competencies and goals. Regardless of form, the primary purpose of objective specification is to state clearly what we expect the pharmacy students to achieve. In other words, what are the intentions of our instruction? Exactly how specific an objective should be is still a matter of concern for the researchers. The form advocated in this chapter avoids the superspecificity advocated earlier by Mager, but still requires enough specificity for adequate communication to other instructors and especially to students who will be expected to master the objectives.

The proper form of objectives is one of the most misunderstood concepts in contemporary postsecondary education. Abuses abound as witnessed by the prolific shopping lists of objectives found in most health sciences schools. Instant expertise was expected from those who spent 45 minutes reading Mager's little text on objective writing. Instead, the result was frustration and, in many instances, rejection. Objective writing for the planning of learning and student assessment is a difficult task which cannot be accomplished overnight or during a two-day retreat. All too often objectives are written to satisfy an administrative directive, only to be discarded when instruction is designed and tests constructed. Worthwhile and valued objectives are difficult to generate. It is hoped that the format suggested in these few pages will aid the instructor in his endeavors.

SUBSTANCE AND FORM

All performance objectives have both *substance and form*. The *substance* of an objective is the *content* or *subject matter* which is used or acted upon by the student and instructor. This content constitutes the stimuli to which the student will be expected to respond during instruction and assessment. The *form* of the objective emphasizes the behaviors which the student will have to demonstrate as a result of having acquired the content. A balance must exist in the objective between the substance (content) and form (specificity) of the action or behavior. The proposed use of the objective will often determine the form that it will take. It must be emphasized that specificity of the objective does not mean usability or value.

EXAMPLES OF SUBSTANCE (CONTENT)

*Phenytoin
*Pharmacokinetic dosing gentamicin
*Indications for antibiotics
*Pharmacokinetics of drug therapy in renal failure

EXAMPLES OF FORM (ACTION)

—Evaluates	—Analyzes
—Applies	—Compounds
—Describes	—Compares

COMPONENTS

1. PERFORMER
2. BEHAVIORAL TASK—Specific / Expanded
3. SPECIFIC/GENERAL CONTENT
4. CIRCUMSTANCES OF ASSESSMENT
5. PERFORMANCE PROFICIENCY
6. REFERENT SITUATION—Academic / Professional

***COMPONENT 1:* PERFORMER**

A performer is the person, student, participant, enrollee or other individual who will be expected to demonstrate the accomplishment of the objective. It may not be necessary to name the performer for every objective if the reference is self-evident. The only purpose for naming the performer is to establish *specific responsibility* for an individual or class of students.

***COMPONENT 2:* A-BEHAVIORAL TASK**

A behavioral task is a capability or action (the form of the objective) which the student will be expected to demonstrate. This task can either require *overt* (observable) action such as compounding, counting, counseling, etc. or an action from which the capability can be *inferred* such as analyzing, calculating, evaluating, etc.

Example of inferred capability:
The student will calculate the proper amounts and volumes of diluents to prepare accurately various strengths and solutions.

The act of calculation is a mental skill which cannot be directly observed. We observe the student writing down or stating the amounts to be calculated. This capability is inferred from the observed behavior.

B-NON-ESSENTIAL PERFORMANCE

Care must be taken not to incorporate nonessential and trivial parts of an objective such as "count," "check-off," "circle," "point," etc., *unless* this is the *exact primary behavior* to be demonstrated by the student.

C-PRINCIPAL PERFORMACE

Only the principal performance or *primary capability* which the student will be expected to demonstrate should be identified in the behavioral task. All objectives must specify the *principal* performance since this will be the basis for the design of instruction and assessment of the student.

The behavioral task is the *most important* component of the objective and specifies WHAT the student will be expected *to know and/or do*. How specifically the task must be described is still the subject of endless debate. The primary use to be made of the overall objective should determine the level of specificity or generality. If the instructor intends that the objectives are to be *test item specific* (the test item and objective read almost exactly alike), he should use action terms such as these:

Examples of Action/Non-Action Terms:

ACTION TERMS		*NON-ACTION TERMS*
constructs		learns
names		understands
labels		appreciates
describes	NOT →	knows
counts		values
inserts		thinks critically
stains		
bandages		
lists		

D-UTILITY OF PRECISE OBJECTIVES

Test item specificity *reduces ambiguity* but does not necessarily mean that the objectives will be useful or of value. Unfortunately, too many performance objectives tend to be *ultra-operational* and are reduced to fragmented bits of behavior which have little utility for learning. This results in endless lists of trivial statements. Remember, these objectives are really test items and will lead to the accusation of teaching to the test. The instructor will have to judge whether or not such low level learning outcomes are really worth the time that it will take to test and correct. If this type of behavior is desirable, provide the student with *self tests* where the student is given the responsibility for checking his own performance.

Ultraspecificity of Behavioral Tasks	Expanded (amplified) Behavioral Tasks
↓ lead to	↓ lead to
Test item specific objectives	Content generality or range of test items and instructional choices

E-EXPANDED BEHAVIORAL TASKS

Expanded behavioral tasks include a *broader range* of behavior and content possibilities but *need further clarification* for the planning of instruction and for the construction of tests, since these tasks do not constitute the exact test item. This type of objective specifies whole *domains* of behavior and defines rules for the selection of content. Expanded objectives address *higher order* intellectual skills than the simple processing of factual information and provide a *balance* between specificity and practicality. Because of the more general nature of amplified objectives, they must be accompanied by a set of rules or procedures which delimit the parameters for content selection and possible student responses.

F-APPLICATIONS

Expanded objectives will always deal with *content generality* and will eliminate trivial objectives which are test item specific. There will be fewer, yet longer, performance objectives for a unit or course of study. Most objectives derived from the validated competencies are expanded objectives; they address *general skills* which may be applied to new learning situations.

EXAMPLES OF EXPANDED OBJECTIVES:

**Develops* and *applies* criteria for monitoring drug therapy.

**Demonstrates* effective verbal communication techniques in a variety of situations.

**Applies* the principles of statute law to pharmacy practice.

**Organizes* available resources to achieve a previously designed management plan.

**Evaluates* O.T.C. product quality.

**Compares* and *judges* the effectiveness of medical-surgical devices and supplies.

G-MAGNITUDE OF BEHAVIOR TO BE SPECIFIED

Since expanded objectives deal with a broader level of behavior than the more traditional test item equivalent objectives, the magnitude of the behavior must be thoughtfully considered. The *time* for the student to complete the behavior is probably the most practical standard to use. It is suggested that it should not take the student any longer than *3-4 weeks* to demonstrate mastery of an expanded objective although there may be exceptions which take shorter or longer periods to master. Expanded objectives may be accomplished in less time, but those mastered in a matter of hours are likely to be intermediate or supporting objectives. As you gain experience with this type of objective specification, you will be better able to judge the magnitude of the behavior specification.

H-ACCEPTABLE EXPANDED OBJECTIVES

Acceptable expanded objectives must be:

- **Practical**
- **Usable**
- **Reasonable**
- **Definitive**

COMPONENT 3: A-SPECIFIC OR GENERAL CONTENT

If a performance objective specifies one segment of limited subject matter as a requirement for testing, then it is test item equivalent.* In other words, the

PERFORMANCE OBJECTIVE = ONE TEST ITEM

This *rigid interpretation* of objective writing has proven to be too limiting; it results in long *shopping lists* of objectives for each lecture or unit of instruction. These objectives have limited use for test construction if the instructor wants the student to develop baseline information only. However, it must be understood that the student *will not be able to generalize* from this type of learning *nor will he be able to transfer* his learning to a broader range of similar learning situations. The student should be made aware that the objective is really a specific test item which he will later encounter.

EXAMPLES:

Test item specific objective—The student will *list* the features of a properly written prescription.

Test item—List the features of a properly written prescription.

Test item specific objective—The student will be able to *cite* five ways in which laboratory tests are useful in drug therapy.

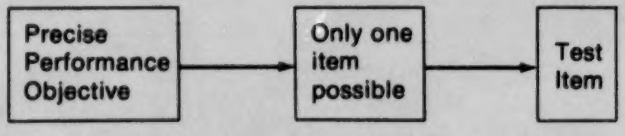
Test item—Cite five ways in which laboratory tests are useful in drug therapy.

B-GENERAL CONTENT

Worthwhile performance objectives should address a *range* of possible content choices, all of which have the same characteristics, but none of which exhaust the objective's content possibilities for either practice or assessment. This range (class, domain or universe) of possible content provides *parallel examples* which have been judged *equally difficult*. A specific example of content drawn from this domain of possibilities provides for a specific practice or assessment situation.

Objectives which refer to specific content are test item specific and allow for no substitution of parallel subject matter. General content specifies a range of possible subject matter substitutions and allows more latitude of subject matter selection among instructors. The student will become able to transfer learning from one subject area to another.

CONTENT SPECIFIC OBJECTIVE (Test item specific)

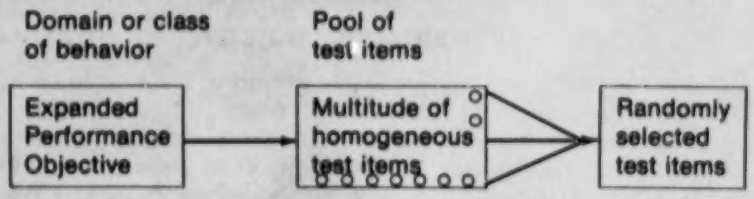


One specific test item satisfies the requirement of the objective. No transfer possible.

Usually information (memory) or simple comprehension.

*Baker, E.L. *Defining Content for Objectives*. Vimcet, Associates, Box 24714, Los Angeles, Calif., 1968.

CONTENT GENERAL OBJECTIVE (generalizable and transferable skill)


Domain or class of behavior
Pool of test items
Expanded Performance Objective
Multitude of homogeneous test items
Randomly selected test items

Given any random selection of an equal number of *test items* (test length predetermined) from the pool of items, there would be an equal probability that the student would achieve at the same proficiency level.

SUMMARY

Expanded performance objectives provide a *balance* between over-precision in objective writing and total vagueness. Content general objectives eliminate the proliferation of test item specific objectives and are easier to justify. The behavior called for in an objective should be applicable to a range of possible content situations and should allow for content homogeniety in potential test item or performance situations.

***COMPONENT 4:* A-CIRCUMSTANCES OF ASSESSMENT**

The circumstances of assessment prescribe the range of possible situations or instances under which the student will be assessed. They specify the constraints and latitude for assessment, and directly influence performance. It may be unnecessary to specify the circumstances for every objective, since the same circumstances may address several objectives in a learning sequence. The circumstances explain HOW the behavioral task is to be accomplished by the student and describe the important aspects of the performance environment. These are the learning variables (stimulus attributes) which the instructor can manipulate and which include any selection of media, teaching methodology, learning environment, special equipment or instruments. The circumstances should be based on the nature of the behavior to be performed.

When possible, the circumstances should approximate the real professional setting in which the student will be expected to work. They should be critical to the expected outcomes and not address insignificant or trivial elements.

B-THINGS THAT COULD BE PROVIDED TO THE STUDENT

Under certain circumstances the instructor might want to provide the student with resources, which could include:

—scientific instruments
—equipment
—profiles
—journal articles
—general information
—special instructions
—professional references
—problem situations
—special environments
—patients (real and role-played)

C-HOW THE STUDENT COULD BE OBSERVED

Depending on the level of specificity desired, the circumstances could also identify where or with whom the student would be observed performing the behavioral task:

- —working alone
- —in the presence of a preceptor
- —working in a group
- —working as a member of a H.M.O.
- —in the clinic
- —on the telephone
- —using a programmed textbook
- —in the laboratory
- —in an urban setting
- —under simulated conditions
- —in an emergency situation
- —viewing
- —reading
- —listing

D-HOW THE STUDENT WOULD PRESENT THE INFORMATION

Under special circumstances the instructor might require the student to *present* the information or solution in a certain manner:

- —in writing
- —in an oral report
- —in the style prescribed
- —in outline form
- —with all references
- —according to journal style

E-WAYS TO STATE CIRCUMSTANCES

- —working in a sterile environment
- —given actual clinical records
- —after reading a case history
- —using the encyclopedia
- —without the use of notes
- —from memory
- —working under simulated conditions
- —working without the use of compendia

Delimiting and clarifying statements such as these depend on the writing style of the instructor and could be found any place within an objective statement.

COMPONENT 5: A-PERFORMANCE PROFICIENCY

The performance proficiency defines what will be accepted as *evidence* that the student has achieved the prescibed behavioral task. This component of the objective usually specifies some *numerical evidence* of performance or delineates specific *criteria for judgment*.

It will not always be necessary to specify the performance proficiency for every objective as a part of the objective statement. This should be included only if it has not been previously stated or if a question should arise as to the desired outcome. In many instances the level of proficiency is arbitrary and negotiable, particularly if you are dealing with informational level objectives.

B-PROFICIENCY VARIABLES

Different objectives or sequences of objectives will require different performance standards or proficiency levels as dictated by professional practice. Some of the factors to consider should include:

*TIME TO COMPLETE—Time should only be considered if it is critical to the performance of the behavioral task. Time as a proficiency measure should not be arbitrarily applied.

EXAMPLES:

1. Dose of epinephrine in a case of cardiac arrest.
2. Request for I.V. compatability of drugs while on the phone.

*MANUAL SPEED—Some tasks must be performed as soon as their need is recognized.

Examples: first aid, arterial bleeding, artificial respiration, dispense an emergency dose of nitroglycerine.

*DEGREE OF ACCURACY—level of precision

Examples: Prescriptions must be dispensed with absolute accuracy.

*LATITUDE FOR ERROR——HOW MUCH ERROR IN JUDGMENT CAN BE TOLERATED?

EXAMPLE:—"Cracked" emulsions are expensive.

*PROBABLE CONSEQUENCES OF ERROR—What effect will an error have on the consumer? If drug given too rapidly, death will result. This could mean loss of life, injury, damage, etc. Is the consequence intolerable or negligible? A missing auxiliary label may contribute to improper storage and consequent product deterioration.

*STABILITY OF THE PERFORMANCE—Must the degree of accuracy be constant over long periods of time? How often will the student be expected to perform over time? Will the student be expected to maintain proficiency?

* HOW LONG BEFORE THE PERFORMANCE WILL BE REFERENCED TO AND INCORPORATED IN PROFESSIONAL PRACTICE? If a delay, will relearning or additional practice be required?

Examples:—selecting a brand based on bioavailability studies

—reviewing a balance sheet

* SAFETY REQUIREMENTS—What are the risks involved?

Examples:—sterility in I.V. and lab

—volatile gases

*HOW MANY CHANCES WILL THE STUDENT BE GIVEN TO DEMONSTRATE MASTERY?

Examples:—Does the preparation of *one* example of a frequently dispensed dosage form provide evidence of mastery?

—Does one demonstration of the addition of an additive to an I.V. solution give evidence of mastery?

*IS THERE A KNOWN REFERENCE TO PROVIDE THE PROFICIENCY LEVEL?

*HOW CONFIDENT ARE WE THAT THE OBJECTIVE HAS BEEN MASTERED?

C-EXPRESSING PROFICIENCY LEVELS

Proficiency levels may indicate the desired mastery of an objective in many ways. Regardless of the means of expression, enough data must be provided so that discrete groups of individuals would be able to agree consistently on the level of mastery achieved by the student under the prescribed circumstances of assessment.

—80% correct

—all must be correct -four out of five

—without any errors

—accurate to four decimal places

—your response must be in accordance with XYZ requirements

—your description of the process must include the following . . .

—neat, clean, and free of spelling errors

—within 300 calories

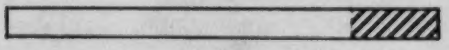
D-ESTABLISHING PROFICIENCY LEVELS

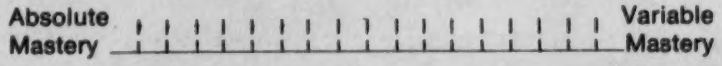
Establishing proficiency levels for student performance is difficult and often misunderstood. Too often these levels are arbitrarily derived by the instructor because he "feels" that the student should achieve at the instructor's prescribed level. H wever, when asked by students to justify his position, he may have to justify his response in terms of factors considered here. There are four possible choices for arriving at proficiency levels:

1. *SUBJECTIVE*—70%; 80%; 90%. This is often difficult to justify, but professional judgment may sometimes be the only posture available.
2. *EXPERT CONSENSUS*—Still arbitrary but less susceptible to error. Judgments such as 90% proficiency would be based on pooled estimates.
3. *CURRENT STATE OF PROFICIENCY IN PRACTICE*—This would involve the administrati n of a test to a criterion group of practitioners who had been judged competent by faculty and other practitioners. The scores obtained could represent the requirements for practice. The lower limits of this group performance would constitute the lower limits of knowledge of existing practice.
4. *TRADITION*—The institution arbitrarily establishes proficiency levels as reflected in grades, although it has been firmly established that there is little correlation between grades and success in the real world.

E-CONTINUUM OF PERFORMANCE

Mastery learning means that a student has demonstrated proficiency in a professional competency, group of objectives or a single performance objective. There are two types of mastery that should be considered:





Absolute mastery indicates an absolute level of performance with no lattitude for achievement variance and is represented by proficiency levels such as 100%. This is an all or nothing mastery level. The student must either meet or exceed the standard. Variable mastery establishes a range or continuum of acceptable performance between minimum and maximum levels.

COMPONENT 6: REFERENT SITUATION

The referent situation relates the objective to some *criterion of relevance* usually external to the course or unit of instruction. This referent helps the student to answer the question, "Where will I be able to use or apply what I have learned—at some future time in another unit of instruction, another course or in professional practice?"

SUMMARY

The six elements of performance objectives were described in detail. It must be kept in mind that not all six elements are present explicitly in all objectives at all times. If the student can understand the expectations of the instructor, that is all that is necessary.

It has been suggested that *ultraprecision* in objective specification may not be necessary or desirable. The purpose for which the objectives will be used should determine the level of specificity or generality necessary. The most significant criterion for objective specification is:

> IS THIS PERFORMANCE OBJECTIVE *REALLY WORTH* THE TIME AND EFFORT TO TEACH AND ASSESS?

REVIEW FORM

WRITING PERFORMANCE OBJECTIVES

A. What is the *behavioral task?*
   1. What do you want the student to do?
      a. Does the task deal with a specific instance of behavior (ultraspecific) or does it encompass a more generalizable task which can be transferred to other learning situations?
         EXAMPLE:
         ULTRASPECIFIC: The student will add 10 + 10.
         EXPANDED: The student will add any two digit numbers from 10 to 99.
      b. Does the behavioral task communicate exactly what is expected of the student?
      c. Is this an intermediate or terminal performance task?

B. What are the circumstances of assessment?
   1. Are these circumstances really important or do they deal with trivial matters?
   2. Are the circumstances explicit or implied?

C. How will the student be evaluated?
   Paper and pencil _____ Simulation _____ Practice

D. What is the expected proficiency level for competent performance?
   1. Is this proficiency level an absolute minimum or is there a continuum of proficiency?
   2. How was this proficiency level derived?

E. How does this task relate to another course, unit or to professional practice?

F. How will the objectives be used?
   1. To design instruction?
   2. To generate paper and pencil tests?
   3. To design observational rating scales?

G. Estimated time for the student to achieve.

Estimated Student Achievement Time	CONSTRUCTING WORTHWHILE PERFORMANCE OBJECTIVES	Related Competency or Terminal Performance Objective.

Behavioral Task A	Circumstances of Assessment B	Method of Evaluation C	Expected Proficiency Level D	Reference E
Ultra-specific → Generalizability to other situations	Implicit in other tasks → Must be qualified	Paper and pencil → Actual performance	Absolute minimum for safety → Arbitrary or necessary continuum	Subjective → Based on professional performance

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This form has been developed to aid you in the construction of worthwhile performance objectives. All the components (A-E) should be considered.

DESIGNING A LEARNING SEQUENCE

Thomas E. Cyrs, Jr.

INTRODUCTION

A learning sequence should be developed *prior to* the preparation of a lecture, unit or module. This assures that all of the important and critical knowledge content and behavioral or skill components have been included and arranged in a logical order. Designing a learning sequence requires the following decisions:

—Deciding *what* the student is to learn.
—Deciding in *what order* it is to be learned.
—Deciding *how* it is to be learned.
—Deciding *how to assess* when it has been learned.
—Deciding on the best method to *teach* it.

This section will address the question of how to decide in *what order* the content and skills should be presented to the student.

WHEN SEQUENCING IS NECESSARY

1. One topic, unit, module or terminal performance objective must be mastered before the next.
2. There is a logical progression from one topic to the next in a discipline.
3. During group-paced lectures when new topics are presented from simple concepts to complex principles.
4. When the student(s) has not attained the level of achievement desired for practice, the presentation sequence should be reviewed and the student questioned to determine if he had the necessary prerequisite skills and understood the concepts as developed during the presentation. It may be that a wider variety of examples are necessary.

> *The sequencing of topics and objectives provides a blueprint or map for the student to follow.*

ELEMENTS OF A SEQUENCE

Designing a learning sequence requires that you analyze two important components:

CONTENT ANALYSIS *BEHAVIORAL ANALYSIS*	=	*WHAT TO KNOW AND* *WHAT TO DO*

The *content analysis* identifies all of the important information, concepts, principles, rules and procedures which the student will have to know and understand in order to perform a skill. This analysis traditionally deals with cognitive or intellectual skills but should also address attitudinal behavior associated with the content.

The *behavioral analysis* requires that all of the content be translated into performance objectives which describe exactly what the students will be required to do once they possess the content and in what logical order they will be expected to perform.

EXAMPLE

Competency #17: Provides Emergency First Aid Treatment.

CONTENT ANALYSIS

1.0 Emergency first aid treatment.
2.0 Emergency situations.
  2.1 Kind and extent of specific problems.
  2.2 Need priority and urgency.
  2.3 Counseling patient.
  2.4 Proper authorities.
3.0 Action decisions.
  3.1 Proper procedures.
  3.2 Availability of equipment and facilities.
4.0 Actions
  4.1 Urgency.
  4.2 Emergency care.
5.0 Legal and ethical implications.
6.0 Follow-up actions.

BEHAVIORAL ANALYSIS

1.0 Provides emergency first aid treatment
2.0 Evaluates emergency situations.
  2.1 Identifies specific problems - kind and extent.
  2.2 Determines urgency and priority of need.
    2.2.1 Interprets signs and symptoms.
      2.2.1.1 Interprets external signs.
      2.2.1.2 Identifies abnormalities of of any kind.
      2.2.1.3 Evaluates pupils. skin coloration. odor on breath. alertness, presence of bleeding, abnormal bleeding, deformities.
      2.2.1.4 Interprets internal signs.
      2.2.1.5 Gathers relevant information from patient and/or others available.
      2.2.1.6 Palpates for signs of injury
  2.3 Establishes confidence with patient and others and gives counsel.
  2.4 Identifies and contacts proper authority.
3.0 Makes immediate decision as to desired action.
  3.1 Selects proper emergency care procedures.
    3.1.1 Removes patient from immediate danger
    3.1.2 Determines mobility immobility of patient.
    3.1.3 Determines shock potential.
    3.1.4 Determines minimum equipment needed.
    3.1.5 Determines other help needs.
  3.2 Identifies available equipment and facilities.
4.0 Takes desired action.
  4.1 Determines urgency of action.
  4.2 Applies proper emergency care in light of available equipment and facilities.
    4.2.1 Improvises suitable equipment.
    4.2.2 Instructs assistants thoroughly.
    4.2.3 Monitors procedure carefully until professional help arrives.
    4.2.4 Reports and records action taken to appropriate authority.
5.0 Identifies legal and ethical implications of situation and actions.
6.0 Determines follow-up action, if appropriate.

EXPLANATION

The behavioral analysis translates the content analysis into specific terminal performance objectives and levels of intermediate performance objectives. The sequence from 1.0 to 6.0 was judged logical by the original content analyst and accepted by a group of peers. In order to design instruction (packages, demonstrations and lectures), each T. P. O. and I.P.O. would have to be further analyzed for detail. Prerequisite knowledge and skills which you "assume" that the student possesses should also be specified. What skills and knowledge would you "assume" that the student would have to have to enter into this learning sequence?

CRITERIA FOR JUDGING ADEQUATE LEARNING SEQUENCES

Learning sequences must identify the *logical steps* which will lead the student to achievement of the objectives. Since the research on learning sequence design is inconclusive at this time, the approach recommended should be based on *your experience* and a great deal of *common sense*. To be usable, a sequence should be:

—Based on a practical and logical approach.

—Achievable by the student within a reasonable time.

—Within the ability and interest of the person designing the sequence.

—Usable for decision making about how to design the teaching or other means of presentation.

—Based on sound learning theory.

A usable sequence also should;

—Discriminate between intellectual and attitudinal components and the actual tasks to be performed.

—Lead the students to the desired proficiency level.

—Consider the prerequisite knowledge and skill necessary.

—Consider the complexity of the subject matter.

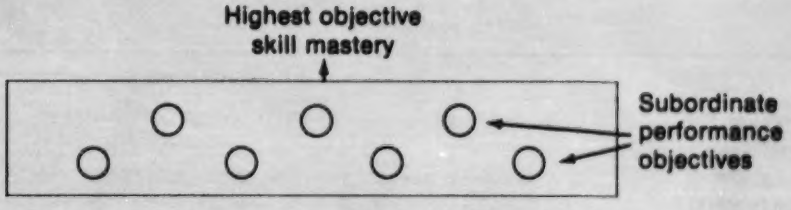
—Provide for an adequate amount of appropriate practice.

—Consider the optimal conditions under which the learning should take place. (e. g. , practice sites)

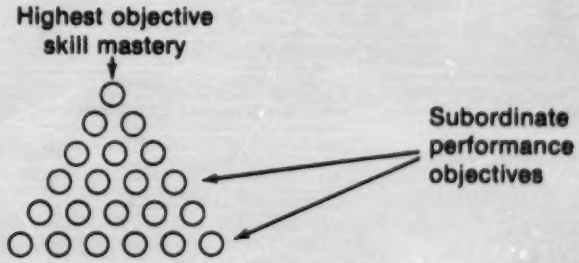
STRUCTURE AND HIERARCHY

All academic disciplines have a structure which implies a relationship among the critical components and which shows both cumulative and prerequisite relationships. These structures can be described as:

Flat Horizontal Structure—Sequence is unimportant. The content and objectives could be presented in almost any order since they are not interdependent.



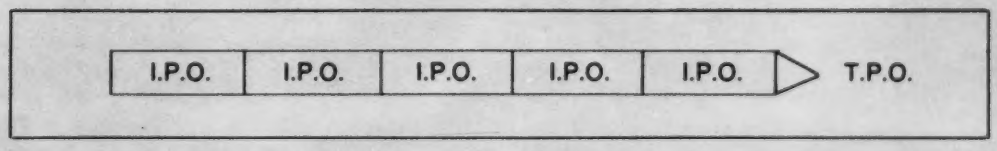
Vertical or Hierarchical Structure—Sequencing is extremely important. There is a logical cumulative relationship among the content components and objectives without which the student would probably not achieve the desired level of proficiency. This type of hierarchical or vertical structure provides the building blocks. However, the procedures are not absolute. Experience with students will provide the data for optimal sequencing.



TERMINAL AND INTERMEDIATE PERFORMANCE OBJECTIVES

The *highest level* of performance expected is called the TERMINAL PERFORMANCE OBJECTIVE (T.P.O.). The T.P.O. usually prescribes the most complex intellectual, attitudinal or manipulative skill, the achievement of which will be expected at the end of a lecture, unit, module or course. The T.P.O. indicates terminal points of instruction. The *prerequisite* supporting components or steps which lead to the terminal performance objective are called the INTERMEDIATE PERFORMANCE OBJECTIVES (I.P.O.). These could be linear or branched in some fashion. The point is that the IPO's must always precede the TPO's.

LEARNING SEQUENCE

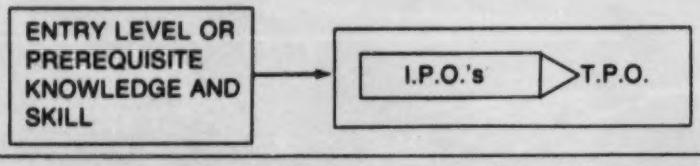


SEQUENCING PROCEDURE

Sequencing of the subject matter requires that you identify all of the facts, information, concepts and principles which, in your judgment, will be required to learn the skill.

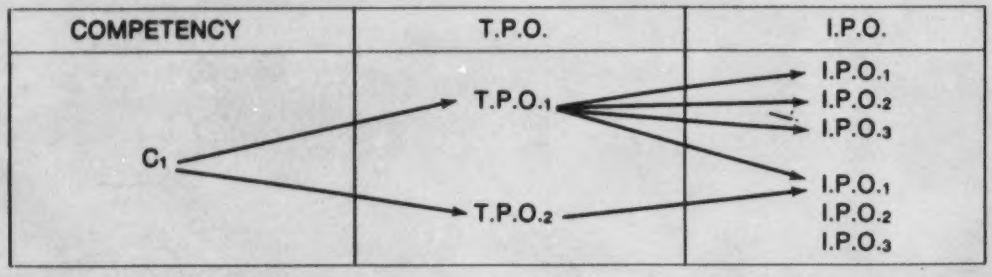
Given the terminal performance objective, you are constantly working *backwards* asking what the prior information or skill is that will be needed by the student to achieve the desired outcome. During the content analysis you are not writing final performance objectives, so the specificity of the language is not important. You are really conducting a content outline which will be translated ultimately into I.P.O.'s.

Continue your analysis until you reach the point where you feel that the student should *already know* the data or skill. This is called the ENTRY LEVEL of knowledge or skill beyond which you feel that you should not develop your lecture or unit. This *ENTRY LEVEL knowledge* could be covered in a *prior* lecture, unit, or course. *Assumptions* are usually made about the prior entry level skills of students. This is true particularly when other instructors have not provided the TPO's for their courses. If these objectives are available then the entry level skills for one unit are the terminal performance objectives from the prior unit or course. In the absence of these previously mastered objectives you will have to make some assumptions about these entry level skills. The big question that you will have to answer is, "Is it fair to make these assumptions, or should I test for these assumed entry skills?" Unless the student possesses these prerequisite skills, he has a higher probability of not achieving your objectives. If you test for the assumed entry skills and find that the student has some deficiencies, then you will have to make some adjustments in your module or presentation. These "assumptions" about entry skills may be one of the greatest causes of failure on the part of the student.



RELATIONSHIP OF T.P.O. AND I.P.O. TO COMPETENCY

A competency is composed of a series of terminal performance objectives (intellectual, attitudinal and manipulative) which address large blocks of behavior. In order to design instructional sequences (or self-instructional packages), the T.P.O.'s will have to be further analyzed into the subordinate component behaviors or I.P.O.'s. Such a sequence could be represented as:



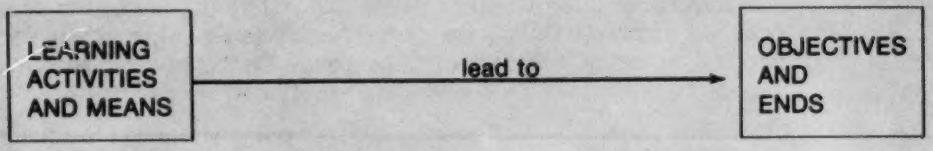
C = competency statement

T.P.O. = terminal performance objective

I.P.O. = intermediate performance objective

LEARNING ACTIVITIES

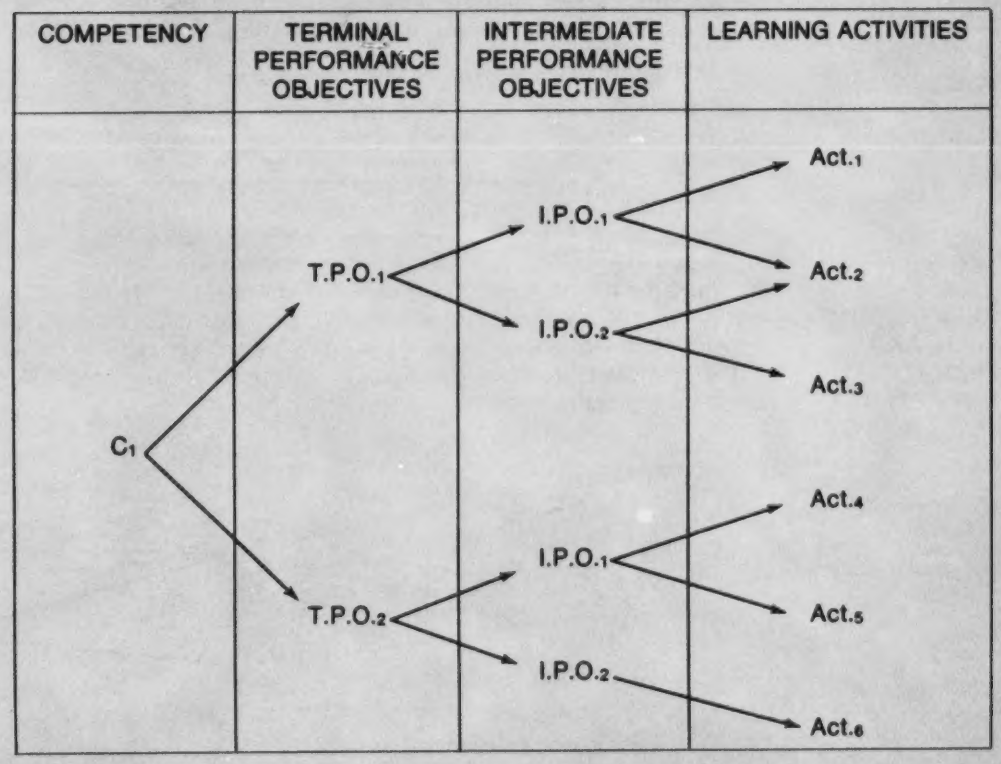
Objectives, whether terminal or intermediate, describe *what* the student is to know and do. *How* the student is expected to achieve the objective is referred to as the learning activity. Activities are the *means* by which the objectives or ends are learned.



EXAMPLES OF LEARNING ACTIVITIES

Attending a lecture.	Participating in a seminar.
Viewing a film.	Joining a fraternity.
Conducting an experiment.	Visiting a pharmaceutical firm.
Reading professional articles.	Developing a poster session.

COMPLETE LEARNING SEQUENCE



A learning activity (such as attending a lecture or viewing a film) could address several I. P.O.'s simultaneously. Single activities *usually* do not address single I.P.O.'s. The selection of the learning activities must be based on the nature of the behavior called for in the objectives. The design of a *complete learning* sequence attempts to answer:

> *Will students participating in these activities be able to achieve the I.P.O.'s and T.P.O.'s?*

Testing will always be directed at objectives, never activities. Each activity is based on or directed toward achievement of an objective. It is usually possible to identify *different* activities which are suitable for achievement of an individual or a cluster of I.P.O.'s:

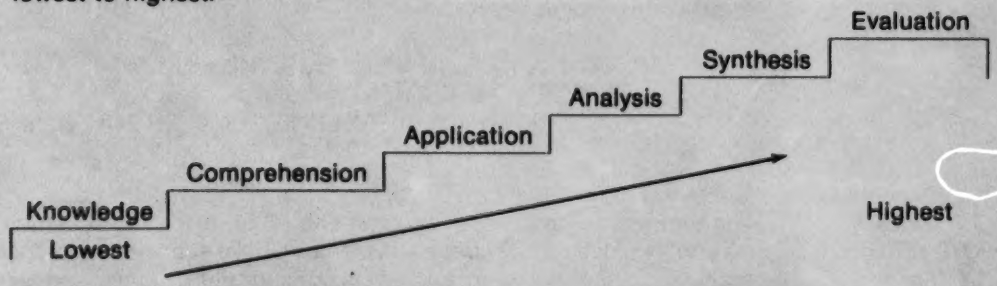
> EXAMPLE: Given the following cluster of I.P.O.'s, the student could:
> Attend a lecture.
> Listen to the lecture on audio tape.
> Read a transcription of the lecture.
> View a videotape of the lecture.
> Review the notes of the lecture taken by a friend.
> Read six chapters of the text.

The most important consideration is the fact that the student demonstrated satisfactorily the achievement of the objectives. The means of achievement is of secondary importance.

DETERMINING THE COMPONENTS OF A LEARNING UNIT

INTRODUCTION

Designing a learning sequence requires that all of the necessary components of a terminal performance objective be identified in terms of what the student has to *know* and *do*. This sequence will identify either a flat or horizontal structure (no logical sequence) or a vertical or hierarchical structure (cumulative learning) where there is an apparent logical sequence. One tool that has aided instructors for many years is *The Taxonomy of Educational Objectives: Cognitive Domain*[1] which describes a logical and progressive (hierarchical) classification scheme for intellectual outcomes. The original taxonomy described six levels of learning outcomes progressing cumulatively from lowest to highest.



The purpose of the taxonomy is to determine the level of intellectual skill required in an objective (as well as test situation) in order to identify prerequisite behavior.

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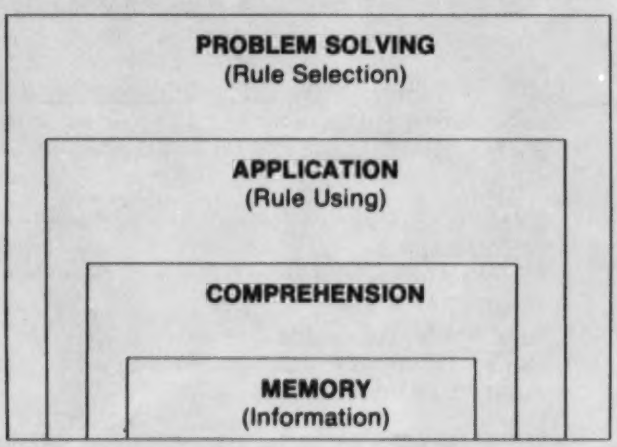
[1]Bloom, Benjamin (ed.), Engelhart, M.D., Furst, E.J., Hill, W.H., and Krathwohl, D.R., *Taxonomy of Educational Objectives—The Classification of Educational Goals, Handbook I: Cognitive Domain*. New York: David McKay, 1956.

REDUCTION OF COGNITIVE LEVELS

For ease of use the entire taxonomy has been reduced to four general levels. Because of the complexity of the upper three levels of analysis, synthesis and evaluation, the classification scheme has been reduced to the heading—"Problem Solving" or "Rule Selection." Application has been sub-titled "Rule Using," and knowledge has been changed to "Memory."



Since the four-level intellectual classification scheme is also hierarchical, it provides a logical means for development of a learning sequence. An objective rated at the application or rule-using level incorporates skills of comprehension or memory and would therefore have components of comprehension objectives as well as informational or memory objectives.

HOW TO USE THE TAXONOMY

RATING PERFORMANCE OBJECTIVES

When an objective is rated at one of the four levels of the taxonomy, only the *intended* outcome is described. It is possible that the *actual* outcome resulting from instruction could be different. For example, in your judgment the student may be learning at a higher level than that called for in an objective.

When actually rating performance objectives, it is always prudent to work in small groups of instructors (interrater reliability is quite high) or at least have the ratings reviewed by a colleague. The first hint of the complexity of the required skill will be found in the behavioral task; however, it is the context of the *total* objective which will dictate the required taxonomic level.

> TALK, ARGUE, REVISE YOUR THINKING UNTIL
> THERE IS AGREEMENT.
> USE THE QUICK-REFERENCE GUIDE ON FOLLOWING PAGE.

T.P.O. AS THE HIGHEST LEVEL

The terminal performance objective should always be rated at the highest level of the taxonomy since it will subsume lesser and more specific skills. Objectives written at the application or problem solving levels constitute the highest levels of intellectual activity and are usually generalizable or transferable to a broad array of learning situations. This is not to imply that there could not be T.P.O.'s at the memory or comprehension levels. It may be that a unit of instruction is prerequisite to higher levels of intellectual activity. An example at this lower level would be the learning of prefixes and suffixes in medical terminology or specific anatomical terminology.

ALTERNATIVE USES OF THE TAXONOMY

USES OF THE TAXONOMY

1. Rate performance objectives for sequencing of instruction.
2. Rate individual test items to assure that they are evaluating the performance objectives at the same level of the taxonomy.
3. Rate classroom questions to determine the level of skill required of the student to answer the question.

QUICK REFERENCE GUIDE TO LEARNING CLASSIFICATIONS

DIRECTIONS After you rate the T.P.O., analyze each question on the prior learning levels.

CATEGORY	QUESTIONS TO ASK
1.0 **MEMORY** (INFORMATION) (The student will have to memorize information without understanding it).	Will the student have to *name*, *list*, or *state* from memory: Terms Procedures Facts Definitions Criteria Principles
2.0 **COMPREHENSION** (The student will be able to identify relationships among ideas).	Will the student have to: —*Describe* or *explain* a procedure? —*Compare* and *contrast* ideas? —*Summarize* or *paraphrase* data?
3.0 **APPLICATION** (RULE USING) (The student will apply a principle, rule, procedure or skill).	Will the student have to *apply* the concepts, information, rules, skills, or procedures to *new and unfamiliar* learning situations?
4.0 **PROBLEM SOLVING** (RULE SELECTION)	
4.1 **ANALYSIS** (The student will break a communication down into the parts and identify relationships among the parts).	Will the student have to: —Make inferences? —Identify logical inconsistencies? —Make clinical diagnosis? —Identify organizational principles?
4.2 **SYNTHESIS** (The student will have to apply knowledge and skill to produce a *unique* (to him) and *original* product).	Will the student have to: —Produce an original communication? —Produce an original plan of operation such as a nursing care plan or laboratory technique, or specialized diet? —Produce an original set of criteria? —Design a new piece of equipment?
4.3 **EVALUATION** (The student will judge the worth of a product based on specific criteria).	Will the student have to: —Evaluate the effectiveness of a new procedure using some *external* criteria? —Evaluate the internal consistency and logic of a point of view?

LEVEL 1.0—MEMORY (INFORMATION)

DEFINITION

Memory (recall) is usually associated with the acquisition of verbal information, rules, principles, numbers, formulas, facts, words and names without necessarily understanding the concepts. There are two types of memory:

1. *Recall* of verbal data in the absence of any cues or prompts. e.g., write the definition of the following terms . . .
2. *Recognition* of verbal data in the presence of cues and prompts. These data have been previously encountered and are familiar to the student. e.g., which of the following is the correct definition for . . .?

> Mnemonic skills or memory aids would be extremely helpful at this level of learning. An example would be the skill of verbal association of relating a new piece of data with something already known.
>
> - lines of the treble clef = E,G,B,D,F, *or* *E*very *G*ood *B*oy *D*oes *F*ine
> - names of the Great Lakes = HOMES *or* *H*uron, *O*ntario, *M*ichigan, *E*rie, *S*uperior
> - members of a quartet = STAB *or* *S*oprano, *T*enor, *A*lto, *B*ass

Performance objectives at this level are really test items since in most cases the objective and test item read almost exactly alike.

Sequencing at the memory level may not be as important as the higher levels of the taxonomy, but the data must be presented in a meaningful context. If long term retention is important then two conditions must be met:

1. The student must understand the relevance to practice.
2. Appropriate practice and review must be provided.

EXAMPLES

Names twelve prefabricated drugs.

Lists five sources of literature for bioequivalence of drugs.

States three references on drug nomenclature.

Lists dosage strengths.

Can state the general effects and uses for each class of drugs.

POSSIBLE ACTION TERMS

The following action terms appear frequently at the memory level. Before deciding that an objective or test item require memory, examine the total context and intent of the objective. The presence of one of these action terms does *not* mean necessarily that the objective requires memory only.

locate	recite
place	state
press	imitate
say	match
copy	select
list	tell
quote	

LEVEL 2.0—COMPREHENSION

INTRODUCTION

Comprehension skills are made up of three categories which include: translation, interpretation and extrapolation of data. Comprehension skills build on memory, however, at the comprehension level the students will be expected to explain the concepts learned by rote memory or usage. A concept such as hard, many, atom or love is an abstract idea which has been generalized from specific instances. Concepts, once comprehended, aid us in organizing and classifying our experience. A building is a building (a concept) whether it is one or twenty stories, round or square. A comprehension of the concept of a building will allow us to *classify* a broad range of structures, regardless of shape, construction or color.

DEFINITION OF TRANSLATION

Translation, the lowest of comprehension, requires the student to change information accurately from one form to another. The *original form* of the communication must be preserved without altering the meaning in any way.

EXAMPLES OF TRANSLATION

—Translate the following graph into a narrative description where you tell what the graphic symbols mean . . .

—The nurse will define in her own words each of the following terms . . .

—The pharmacy intern will explain: T.I.D., B.I.D., O.T.C. . . .

—Translates ideas into written verbal terms and speaks to listeners in their terms.

DEFINITION OF INTERPRETATION

Interpretation requires the student to summarize or explain a communication in a *new* way by reordering or rearranging the sequence of events. *Relationships* among major ideas must be clearly seen and understood. It is the *EXPLICIT* content that the student deals with and not the form or structure in which the content is presented.

EXAMPLES OF INTERPRETATION

The student explains drug stability and usage.
Describes common research designs.
Explains PSRO monitoring standards.

DEFINITION OF EXTRAPOLATION

Extrapolation requires the student to extend data in time in order to make predictions of possible outcomes and consequences of the action. Extrapolation often involves IF-THEN types of questions which are answered by informed opinion.

EXAMPLES OF EXTRAPOLATION

The nutrition student will predict personal health problems that might develop because of particular eating habits and will tell how the community in general might be affected.

OTHER ACTION TERMS FOR COMPREHENSION SKILLS

Discriminate (between good and poor examples of . . .)
Select (from given selections, those which . . .)
Organize (the following data . . .)
Pick out (the best specimen . . .)
Reorganize (the data dealing with . . .)
Choose (those characteristics which exemplify . . .)
Describe (the process by which . . .)
Explain (how the cells . . .)
Compare and contrast (these two positions on . . .)
State (in your own words . . .)

LEVEL 3.0—APPLICATION (RULE USING)

INTRODUCTION

The process of application involves the student's ability to combine in the concepts implied known principles and rules, into meaningful relationships and apply them to *unfamiliar* and previously unencountered learning situations. The rules (abstractions) are applied in concrete situations which require some type of solution or product. The students must have a clear understanding of the data and procedures *before* they can apply them. Application always requires the transfer of training to new learning situations. Objectives at this level are *never* test item specific since there are many different test situations which could be used to assess the ability of the student. Extreme testing situations should be avoided since they will frustrate the student. Once the student is able to deal with a broad range of new situations, less common applications can be introduced. Rule using forms the basis for problem solving strategies.

EXAMPLES

—Construct six examples of performance objectives each containing the essential elements as previously described.

—Using any person as a hypothetical subject, the student nurse *will apply* a figure eight bandage.

—Given a table of incidents of heart attacks among men of varying ages and weights, the student *will compute* the change in risk of heart attack in a 40 year old male effected by a 20% weight loss.

—Weighs and measures substances.

OTHER ACTION TERMS

Calculate (the perimeter of this room . . .)

Apply (the principle of . . . to . . .)

Estimate (the value of . . .)

Figure (the area of . . .)

Find (examples of . . .)

Convert the following to the metric system . . .

Construct an example of a performance objective . . .

Perform the following test . . .

Demonstrate the use of . . .

Set up and operate . . .

Classify each specimen as . . .

LEVEL 4.0—PROBLEM SOLVING

INTRODUCTION

The application of principles and concepts in a rule using situation is fairly obvious. We apply X type of rule in a Y type of situation. Problem solving on the other hand requires that the students have to *select* the most appropriate rule or rules and then apply them. In many instances these concepts and rules will have been learned in other contexts. Problem solutions require the students to *integrate* previously learned solutions to new and novel situations and thus expand his problem solving ability. This type of learning has been referred to as discovery learning which requires divergent thinking where fixed and obvious solutions are the exception. Problem solving requires the student to develop cognitive strategies and involves the mental gymnastics of analysis, synthesis and evaluation which are explained separately as subsets of problem solving, but are treated collectively for the purposes of classifying objectives and test items.

Problem solving strategies are usually developed independent of specific content and can be used in any subject area. Unless individual rules have been previously mastered, problem solving will be difficult and almost impossible, since these strategies involve novel combinations of individual rules as proposed hypotheses. As solutions are evaluated, new rules are integrated as new hypotheses. The process is repeated until a satisfactory solution is derived. This process results in new learning for the student which can be applied in other situations.

LEVEL 4.1—ANALYSIS

DEFINITION

Analysis involves breaking a communication or product down into the essential component parts and relating the parts to each other to discover *new* relationships. This process deals with the form or structure in which the data is presented as well as the content. A student could be required to analyze the various *elements or parts of a communication*, such as a problem being investigated or conclusions reached in an investigation by a researcher. Another type of analysis deals with the *relationships* among the various elements of a communication such as between hypothesis and conclusion of a study. The highest form of analysis deals with the *principles* by which a communication is organized. The students must have a formal knowledge of analytical principles such as induction, deduction, formal logic, etc.

EXAMPLES

—The student nurse will distinguish facts from fallacies on a given list of statements about food.

—Given an article dealing with current pharmaceutical research, the student will determine in a written paper if the conclusions reached by the author support the hypothesis.

OTHER ACTION TERMS

Analyze (the relationship between . . . and . . .)

Diagnose (the problem with . . .)

Identify (the true intent of . . .)

Discover (the cause-effect relationship . . .)

Resolve (the differences between . . .)

Detect (the techniques used to . . .)

LEVEL 4.2 SYNTHESIS

DEFINITION

Synthesis, also referred to as creative behavior, involves combining elements of a communication in such a way as to make it *UNIQUE* and *ORIGINAL* for a student at a certain period of time. The *new* structure of the product or idea must be *clearly* distinguishable from the prior structure. The act of synthesis could be expressed as a *unique communication* for the purpose of describing, persuading or entertaining. Synthesis could also be expressed by producing a new plan of operation or set of procedures. Also involved is the ability of a student to develop a set of abstract relations in the form of a theory or hypothesis.

EXAMPLES

Given a set of data, the pharmacy student will propose an original hypothesis and test it. Based on his test results he will verify or modify the hypothesis.

Each nutrition student will write an original paper concerning reasons why vitamin supplements should not be taken indiscriminately. Three reasons given by the A.M.A. should be included plus specific documentary evidence for your reasons . . .

Given a case study of a child with infantile exzema, each student will write a nursing care plan identifying two problems in each of the following areas: medical, psychological, growth and development; and plan two interventions applicable in a hospital setting for each of these problems.

Given the following materials: Daily Food Guide and Food Models, the student will set up a teaching plan emphasizing use of the basic four in planning a balanced diet for use in patient teaching.

OTHER ACTION TERMS

Compose (an original . . .)
Develop (a theory which . . .)
Devise (an original solution . . .)
Invent (a way which . . .)
Produce (a story which . . .)
Tell (an original tale . . .)
Plan (a meal which . . .)
Design (a set for the Plan . . .)

LEVEL 4.3 EVALUATION

DEFINITION

Evaluation is the highest category of the intellectual endeavor where the results of analysis and synthesis are judged according to some internal or external criteria. The judgments may be either quantitative or qualitative and may be generated by the student or given to him in some form. Evaluation might involve some value judgments.

EXAMPLES

Given opposing arguments dealing with the use of marijuana, the student will evaluate them according to the following criteria . . .

Given a patient diagnosed with an upper extremity problem, the student will assess the extent of the abnormality according to the criteria:

atrophy

loss of mobility

obvious patterns of compensation

With the use of a calorie counter and a chart of the four basic food groups, the student will estimate from the weekly diet and regime of activity of a 150 pound, fifteen year old boy whether or not the individual is receiving the recommended allotment of food from each of the four basic food groups and whether or not that individual's caloric intake is in keeping with the amount of energy he expends.

OTHER ACTION TERMS

Assess (the accuracy of . . .)

Judge (the efficiency of this method . . .)

Estimate (the real worth of . . .)

Argue (the value of . . .)

CONCEPT — **AFFECTIVE OBJECTIVES**

INTRODUCTION Up to this point, we have discussed mainly objectives which fall into the cognitive category. Evidence of achievement is relatively concrete to measure, particularly at the lowest three levels of the taxonomy. When affective behaviors are discussed, concrete evidence of objective achievement is more difficult to measure. We can only make inferences from observed behavior that the objectives have been achieved. Affective behavior is an internal state and cannot be measured until the student exhibits behavior from which we infer certain attitudes. These internal states are influenced by cognitive learning both formally and informally. All instructors want their students to like their subjects and be interested in school. Measurement of such lofty goals can only be accomplished by observing behaviors that appear to indicate that the student is achieving the objectives. Such "indicator behaviors" might include smiles, frowns, excitement, eagerness, boredom, restlessness or commitment. All of these indicators reflect some change in attitude which could be affected by environment, background, abilities, and interests, and even the personality of the instructor. Although most attitudes are learned incidentally, it is possible to structure certain elements in a learning situation which are designed to affect student attitudes.

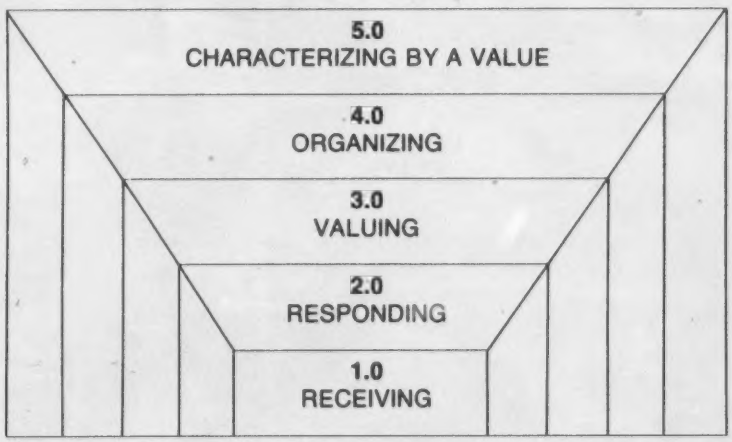
COMPARISON

***COGNITIVE* OBJECTIVES IMPLY A *CAPABILITY*.**
THE STUDENT *CAN* DO IT.

AFFECTIVE OBJECTIVES IMPLY A *PREFERENCE*.
THE STUDENT *WILL* DO IT.

HIERARCHY OF AFFECTIVE OBJECTIVES

HIERARCHY An attempt to develop a hierarchy of objectives in the affective domain was made by Krathwohl, Bloom and Masia* in recent years. Each category of the taxonomy will be further explained.



REFERENCE *Krathwohl, David Benjamin S. Bloom, and Benjamin B. Masia. *Taxonomy of Educational Objectives—The Classification of Educational Goals, Handbook II: Affective Domain*. N.Y.: David McKay Co., Inc., 1964.

LEVEL 1.0 RECEIVING

DEFINITION	When a student is receiving or attending to something he is demonstrating an awareness of its existence through some type of stimulus in the environment. Once aware of the stimulus (color, sound, music, etc.) the student must then give it some measure of his attention by accepting it.
EXAMPLES	The student listens attentatively to a speech by a noted pharmacist. The student notices the furnishings in the Pharmacy. The student appreciates the native costumes worn by the foreign students.
ACTION VERBS	*Some action verbs might include*: select, accumulate, share, accept.

LEVEL 2.0 RESPONDING

DEFINITION	The students not only receive the stimuli from their environment, they actively respond in some way to it without having known in detail or depth why they are doing it. It is possible that the students are acting out of fear of punishment or reprisal.
EXAMPLES	The student willingly obeys the "No Smoking" rule in designated areas of the hospital. The technologist obeys the laboratory regulations for safety.
VOLUNTARY ACTIONS	The next level of responding is characterized by the student's *voluntary actions*. They actually *desire* to perform the act.
EXAMPLES	The student volunteers to discuss the topic of therapeutic abortion. The student voluntarily practices the simulated clinical procedures.
PERSONAL SATISFACTION	Once the student responds willingly without fear of reprisal, some type of *personal satisfaction* usually follows accompanied by joy and pleasure.
EXAMPLES	The student vigorously applauded the noted speaker on cardiovascular disease. The student seeks out other students interested in lipids to discuss the topic.
ACTION VERBS	*Some action verbs might include*: comply, approve, discuss, volunteer, follow.

LEVEL 3.0 VALUING

DEFINITION

When students value something, they place a certain worth on it. Things or ideas that are valued become part of an individual's belief and are consistent in the individual's assessment. We say that the student "holds a value" which will be consistently applied in most situations. The value exerts a great influence over the student's behavior and constantly motivates him. There are degrees of valuing which range from *acceptance* of a value (lowest level of certainty), preference for a value (student seeks it out and wants it), commitment to a value (highest degree of certainty).

CRITERIA FOR VALUING

According to Raths & Simon* the process of valuing must meet the following criteria:

Choosing:
1. Freely
2. from alternatives
3. after thoughtful consideration of the consequences of each alternative

Prizing:
4. cherishing, being happy with the choice
5. willing to affirm the choice publicly
6. doing something with the choice
7. repeatedly, in some pattern of life

EXAMPLES

The student contributes money to help support the local visiting nurse group.

The student constantly argues in favor of socialized medicine.

ACTION VERBS

Some action verbs might include: assist, help, support, argue, protest.

REFERENCE

*Raths, Louis E., Harmin, Merrill and Simon, Sidney B. *Values and Teaching*. Columbus, Ohio: Charles E. Merrill Books, Inc., 1966, Page 30.

Refer to the section entitled:
"Values Education for the Health Sciences":
For A Comprehensive Treatment of This Subject.

	LEVEL 4.0 ORGANIZATION
DEFINITION	As students begin to value different ideas and things, it becomes necessary to organize and synthesize the value structure into some type of *hierarchy* and to identify relationships among different values. The student also conceptualizes or abstracts the values so that new values can be related and compared. This begins to form the basis for a personal philosophy of life.
EXAMPLES	The students formulate criteria by which they will conduct their moral behavior. The student forms judgments as to the responsibility of individuals for actively participating in movements against all forms of abortion.
ACTION VERBS	*Some action verbs might include*: revise theories, change behavior, avoid circumstances, resist excess.

	LEVEL 5.0 CHARACTERIZATION BY A VALUE OR VALUE COMPLEX
DEFINITION	The student at this level of internalization is characterized as being guided by certain beliefs which affect his total behavior. Given certain situations, you can almost predict how the individual will behave because the value system is so much a part of him. He acts consistently and at times almost unconsciously. This level is actually the guiding philosophy of life which controls a student's every action.
EXAMPLES	The student refuses to accept answers offered on an anatomy final exam that he knows he will fail. The student revises personal judgments in the presence of alternative evidence. When eating in the hospital cafeteria, the student will consistently choose a balanced meal that will contain foods from each of the four basic food groups.
ACTION VERBS	*Some action verbs might include*: revise theories, change behavior, avoid circumstances, resist excess.
SUMMARY	These five levels of affective outcomes should be reviewed as a guide and *not* as an absolute hierarchy. The examples provided should be refined in some instances and expanded in others. When reading each, try to identify as many indicator behaviors as possible that would provide evidence that the student had achieved the objectives.

DESIGNING SELF-INSTRUCTIONAL PACKAGES

Thomas E. Cyrs, Jr.

INTRODUCTION

A learning package is a classroom management strategy which allows the student to work through a predetermined sequence of performance objectives and related instructional activities independently, in collaboration with other students or under the direct influence of the instructor. This concept provides an alternative to the more traditional teacher-centered approaches for curriculum design and places primary responsibility for learning on the student. In essence, a learning package provides degrees of guided learning.

Learning packages come in many forms under such titles as UniPacs, Learning Activity Packages, Teaching-Learning Units, Study Guides and Contracts. Regardless of the prescribed form, all learning packages include:

- performance objectives
- learning activities
- student evaluation procedures

Some packages are self-directing, self-correcting, self-pacing and self-contained, while others are designed for group instruction. The package concept will allow you to divide your course into meaningful units of instruction based on clusters of supporting objectives derived from a single terminal objective or small group of related terminal objectives, which in turn have been derived from the validated professional competencies.

This chapter is divided into two sections: background and explanation of learning packages and a suggested format for the design of packages. This format is not meant to be rigid, but is merely provided as a guide. As you gain experience in the construction of packages you will probably adjust this format to meet your own requirements.

There is a collection of assumptions on which learning package use is based:

- Faculty should manage rather than broadcast information.
- Self-pacing is desirable.
- The progress of the student through the curriculum should be based on demonstrated performance.
- Performance standards should be held constant.
- Students can learn independently of an instructor.
- There is a need to identify alternatives to the more traditional group-paced lecture.
- Most student populations in professional education are homogeneous in terms of ability.
- Performance, rather than completion time, should be held constant to ensure competence. If this assumption is acceptable, then the time variance for package or course completion must be based on realistic constraints as determined by the faculty.
- Packages can be designed as independent entities which can be used in sequence or as supporting content.
- Students need constant positive reinforcement of achievement.
- Presentation formats should be varied to maintain interest and improve motivation.
- Some students more than others need tutorial time with instructors.
- Some students can already achieve some of the course objectives because of prior experience.
- There are no laws of learning which apply to all.

- Students should know what is expected of them throughout the instruction so that they can focus their attention and effort.
- Instruction should be individualized rather than group-centered.
- Student assessment procedures should be matched to the skill required in the performance objectives.
- If a student does not meet the performance expectations of the instructor he should have an opportunity to re-cycle through the instructional material.
- There are certain levels of competence which all students must meet. These competencies are generic to professional practice.
- If students agree to an achievement level (contracts) and understand the rationale for the level of achievement (relevance), they will have a higher probability of demonstrating mastery of the performance objectives.

SECTION I
EXPLANATION AND RATIONALE FOR STUDENT LEARNING PACKAGES

DEFINITION OF A LEARNING PACKAGE

A learning package is a *self-contained* set of teaching/learning materials in any form. Completion time varies from a few hours to a few weeks. It is *predesigned* as a classroom management strategy to help the student achieve specified didactic or clinical performance objectives which have been derived from the validated competencies. It is *self-directing* and *self-correcting* and provides for a wide variety of learning styles by incorporating a range of commercially available or locally produced *multi-media* instructional materials. The module allows students to pace at their *own rates of speed* so that learning progress is known to both students and instructor at all times and is based on *measured understanding*. The package is a complete instructional system.

Learning Contracts

A learning contract is a specific study plan which outlines what the student is expected to do, how it is to be done and how achievement will be evaluated. This is the simplest form of a package. The learning contract is not in itself as self-contained as the package and is much shorter (1-2 pages) in format. A contract is a written, signed agreement between the individual faculty member and a student to achieve a set of performance objectives within a specified period of time. An instructor may designate a specified number of contracts for all students with an evaluation of satisfactory or unsatisfactory. If desired, a student could contract to complete a learning package.

LEARNING CONTRACT

Course_____ Competency_____

WHAT YOU WILL BE EXPECTED TO DO

T.P.O._____ I.P.O._____

HOW YOU SHOULD PROCEED

HOW YOU WILL BE EVALUATED

(Include sample test items and terms of the contract for a letter grade or a satisfactory/unsatisfactory).

STUDENT'S NAME_____ COMPLETION DATE_____

INSTRUCTOR'S NAME_____

Characteristics of Learning Packages

One might say that textbooks were initially conceived as learning packages which provided a student with all the structure and information needed to learn. P.S.I. or the Keller Plan does provide a technique to convert student texts to packages as described in this section. Although many good texts are available, they do not contain the design characteristics proposed in this section. Instructional packages contain specific characteristics which make them distinct from conventional textbooks or multi-media kits. Regardless of the physical format of the individual packages, the following characteristics will be found:

1. *Defined population*. Each package is designed for a specific population of students who have similar levels of knowledge and skill.
2. *Single or multiple concepts*. The package format facilitates easy identification and management of ach concept or procedure to be learned.
3. *Specified performance objectives*. Information within the package indicates specifically what the student is expected to know and to do. A package is based on one or several related terminal performance obgectives and the supporting intermediate performance objectives.
4. *Relevant content*. Selected content or subject matter must relate to the achievement of the performance objectives.
5. *Variety of media*. The media, including paper formats, are selected on the basis of the performance objectives and are completely integrated into the package.
6. *Integrated or supplementary instruction*. Instructional packages can provide remedial or enrichment instruction. They may form the entire course or any segment of it.
7. *Self-directing*. The package provides any information or directions that the student needs to achieve the objectives. It is basically a classroom management device which provides highly specific and structured directions; it can direct the student to form small groups and to conduct certain activities.
8. *Various strategies*. The package might direct the student to work alone or in small groups or to attend large group demonstrations and lectures.
9. *Self-pacing*. Students move at their own rates of speed depending on the nature of the package. A student who does not understand the concept is not forced to keep up with the class. Student progress is based on measured understanding of the topic, skill or procedure.
10. *Continuous reinforcement*. The student and the instructor know at at all times how well the student is doing. This is accomplished through the use of self-tests, peer testing and instructor administered tests.
11. *Adequate practice*. The student is given the opportunity to practice the skill, principles or rule in a variety of different applications. The amount of practice provided will depend on the level of performance required and the consequences of the performance.
12. *Relevant evaluation*. All guesswork in testing is removed. The students know exactly how they will be evaluated and are able to distinguish relevant from irrelevant subject matter. Assessment is based on the criterion specified in the performance objectives. A variety of assessment devices will be used: paper and pencil tests (pre-, post-, self-), observation, projects, simulations, laboratory practice and any other form which adequately reflects the objectives.
13. *Field-tested*. The instructional package should be tried out on an adequate sample (2-3) of the student population to determine if the activities and resources will, in fact, help students to achieve the objectives. The sequence of objectives and activities should be modified until the students achieve at the desired level.

The above criteria distinguish learning packages from textbooks and from most of the available multi-media kits.

INSTRUCTION IS INDIVIDUALIZED AND PERSONALIZED WHEN THE FOLLOWING CHARACTERISTICS CAN BE OBSERVED:

1. Time spent dealing with a specific aspect of learning is determined by performance and not arbitrary blocks of time; which means that the student stops what he is doing regardless of interest, understanding or motivation and starts to do something else.
2. Students are treated as individuals and not as part of a group. Based on the student's past experience, performance, interests and motivation, specific learning sequences are selected or designed to meet his needs.
3. Student progress is determined by demonstrated achievement of specific performance objectives. In other words, a student is measured against his own progress as it relates to a stated proficiency level, and not compared to a group norm.
4. Students participate in many of the instructional decisions and have a right to question why they are expected to achieve certain objectives if they do not understand the relevance to professional practice.
5. The students have an opportunity to see the performance objectives they will be expected to achieve and know exactly how they will be assessed.
6. The students are able to choose their own learning method. They select a desired medium from available options.
7. The student has the opportunity to interact with his peer group or the instructor when appropriate.
8. At all times, the student knows how well he is performing in the learning sequence and can request to be tested whenever he feels he has mastered the learning.
9. The student is able to distinguish between subject matter relevant and irrelevant to achievement of the objectives.

CHANGED ROLE OF THE INSTRUCTOR IN AN INDIVIDUALIZED PROGRAM

1. Except when lectures are necessary, the instructor ceases to be the central figure in the classroom, becoming instead a partner in the learning enterprise who would be found among small groups of students.
2. The instructorparticipates in design and field testing of packages of instructional materials.
3. The instructor is involved in teams which diagnose learning difficulties and recommend alternative learning paths.
4. The instructor helps the student select alternative learning sequences and works with students who are less motivated or less self-directed.
5. The instructor may participate in a teaching team which is organized to help students achieve specific objectives.
6. The instructor is constantly involved in student assessment which takes place prior to, during and after instruction.
7. The instructor accepts responsibility for managing the learning environment in such a way that students learn. In other words, the instructor will be accountable for all learning or lack of learning that occurs.
8. The instructor focuses attention on the student instead of on the teaching techniques.
9. The instructor emphasizes higher order intellectual skill development instead of memorization.

VARIETIES OF STRUCTURES IN PACKAGE DESIGN

FIRST VARIETY

Individual instructional packages can incorporate a number of plans. The *first* is a fixed sequence of performance objectives and learning activities defined and sequenced by the instructor to lead the student towards mastery of specific skills. There are two possible uses of this type of package:

a. The instructor designs and assigns the package. The student does not have any voice in deciding which he will use. The instructor exercises this option through the specific identification of deficiencies in the student's learning repertoire as they are revealed by diagnostic testing procedures.

b. The instructor designs or has available several instructional packages in a subject area. The student is given the freedom to select the package he is most interested in working through. Once selected, the student completes a fixed learning sequence prescribed in the package.

SECOND VARIETY

The *second* type of package which can be developed offers the student more latitude in choice of learning activities. The instructor defines and sequences the performance objectives and selects a range of learning activities. The instructor can either assign the package or allow the student to choose the package. In either case the student has the option to select any or all activities in any order or perference as long as he can achieve the stated objectives. We could find this type of package in any curriculum area where some type of structure is inherent in the subject matter, as in mathematics. For this method, the same individual activities could be prepared in a variety of media formats such as print, audio tape, slides, film, etc. The student would select those activities in the medium that best match his individual preferences.

THIRD VARIETY

A *third* type of package would offer greater latitude for the student in sequencing his instruction. The instructor would identify a number of performance objectives and possible activities. The student is given the responsibility for making all instructional decisions within this framework. This type of package differs from the second variation in that the student determines the sequence of *objectives* as well as *activities*. The second variation allows latitude in the selection of activities *only*. This type of package would apply to those curriculum areas that have a horizontal structure, that is, where there does not appear to be a natural sequence of units building on each other. The Humanities, many aspects of social studies, and other "liberal arts" would fall into this category.

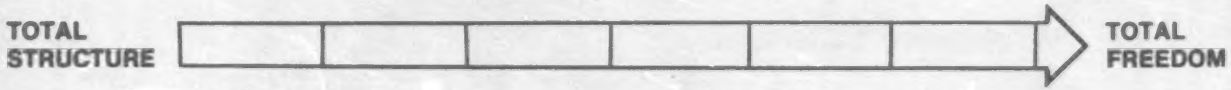
FOURTH VARIETY

The *fourth* type of package would lend itself completely to *independent study*. The student would be given complete freedom to state and sequence his performance objectives and identify all activities which he would work through to achieve the objectives. The instructor would be called on as a consultant. The student identifies the framework for his own study and accepts the responsibility for achieving the objectives.

A complete range of possible structures is presented in the following chart:

VARIETIES OF STRUCTURE IN LEARNING PACKAGE DESIGN

Instructor	Designs and assigns package	Specifies objs. and variety of activities	Specifies objectives and activities	Specifies objectives	Negotiates objectives	Approves objs. and activities	Consultant only
Student	Accepts pre-designed packages	Accepts objs. but selects from given activities	Sequences own objs. and selects from given activities	Accepts objs. and identifies own activities	Negotiates objs. and selects own activities	Specifies objs. and activities activities	Designs own package



PACKAGE SIZE AND LAYOUT

Learning packages can require any length of time to complete and can take on any physical form. A total course would be composed of smaller individual packages. Nothing prevents individual packages from being developed at random within an existing curriculum structure as supplementary or enrichment units. This is most commonly done by individual instructors. These individual packages could take anywhere from one to several weeks to complete. (Recommended average time is 15 days working 1 hour per day). The physical layout of individual packages can assume any form, ranging from student learning contracts printed on individual 8½"x11" sheets to the larger instructional packages, five to fifty pages in length, containing all necessary information. An instructional package might consist of a combination filmstrip, audio tape and worksheets or might include videotapes tied in with interactive response textbooks. Regardless of format or specific components, if a unit has the elements of systems design we have been discussing, it qualifies as a learning package.

SECTION II
STEPS IN THE DESIGN OF A LEARNING PACKAGE

There are 10 sequential steps in the design of a learning package:

1. Select a *single* terminal performance objective or cluster of closely related terminal performance objectives from the essential ("must have") competencies or desirable ("should have") competencies.
2. Conduct a content and behavioral analysis of each terminal performance objective to identify all supporting intermediate performance objectives.
3. Identify all personal, physical or environmental constraints.
4. Construct student assessment measures.
5. Select teaching-learning strategies.
6. Select presentation media.
7. Assemble the learning package.
8. Field-test learning package (formative evaluation).
9. Produce final package (summative evaluation).
10. Monitor package use.

STEP 1.0 Select Single Terminal Performance Objective

The first step in the design of a package is based on three assumptions:

1. The user or target population of students has been clearly defined.
2. All professional role competencies have been identified through panel consensus, evaluated by a broad population of faculty, students and practitioners in terms of their value for contemporary or future practice and validated through on-site job analysis.
3. All validated competencies have been content analyzed into terminal performance objectives and have arranged into some sequence.

If these assumptions have not been met, it is still possible to design a learning package by ***assuming*** that the objectives and/or competencies are valid. If the objectives have been content analyzed, then inspection will reveal among the terminal objectives logical relationships which can be used in designing a package. If the same terminal objective appears within different competencies, this should be noted in the package instructions.

Objectives should be clustered around a single concept, principle, rule or procedure and should take the student approximately fifteen working hours to complete. This time estimate is based on one hour of work per day for fifteen days. Packages could be shorter or longer. However, experience has shown that fifteen hours is a manageable unit of instruction.

Examples of Manageable Packages:

- Weighing and measuring powders, ointments, creams and liquids.
- Appropriate label information.
- Evaluating the relative therapeutic worth of medical-surgical devices.
- Locating appropriate drug information.

STEP 2.0 Conduct Content and Behavioral Analysis

Once the topic for the terminal objective cluster has been identified, it will be necessary to further analyze each terminal objective to identify all supporting intermediate performance objectives. Working with each terminal performance objective you will be asking, "What will the student have to know or do in order to master the objective?" Your analysis will always work *BACKWARDS* from the desired terminal performance objective to the supporting skills necessary to master it. You will reach a point in your analysis where you will feel that the student should have learned the background data in another package or course. This is called the entry or prerequisite level beyond which you should not continue your analysis.

The "Quick Reference Guide to the Taxonomy" will aid you in your content analysis. A graphic example of a content analysis of a professional competency is presented on the next page: This is followed by the procedures required to construct worthwhile performance objectives.

STEP 3.0 Identify All Constraints

Constraints include anything which would inhibit the design and implementation of the package. Constraints can be physical, environmental or personal. Before actually designing the package you should answer the following questions:

1. Where will the student use the package?
   a. in the classroom
   b. in the library or resource center
   c. at home
   d. in a clinical setting
   e. at the place of the clerkship or externship
   f. a combination of the above
2. If the students are to use the package in the classroom or resource center, does it have enough equipment and electrical outlets?
3. How much equipment is available and how accessible is it?
4. If equipment is available, who will train the students to use it?
5. Will the administration allow flexible time in the library for the student to complete the activities? Are class schedules flexible enough to allow many students to work individually?
6. Are duplicating facilities (mimeo, ditto, photocopier) and adequate paper supplies available to reproduce the packages? If so, is clerical help available?
7. If instructional media such as audio tapes, slides, etc. have to be produced, are the proper machines available and are the techniques of media production known?
8. Is there enough raw stock available such as : unused audio tape, photographic film, overhead supplies, etc. to make necessary instructional materials?
9. Are there any funds to purchase commercially available instructional materials such as filmstrips, 16mm films, records, and tapes?

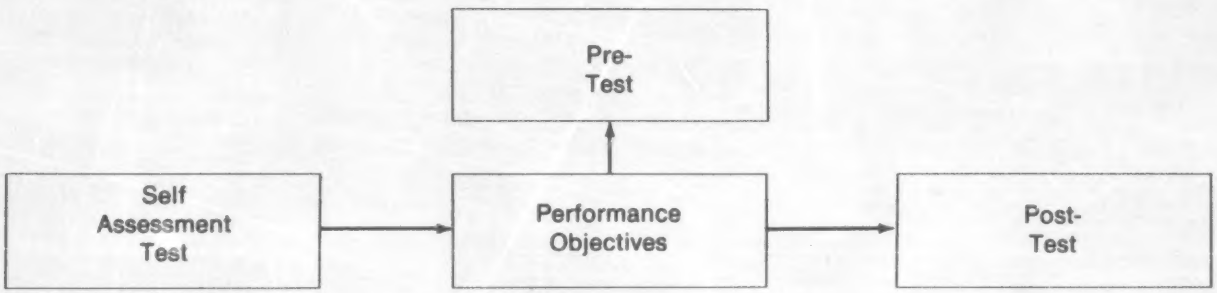
These questions are not meant to discourage development of packages but could represent real world constraints on the type of package you develop and the degree of effort you expend. All these questions should be answered *before* proceeding.

STEP 4.0 Construct Student Assessment Measures

Assessment measures include all pre-tests, post-tests and self-assessment tests. These measures are developed from, and must reflect the intent of, each performance objective and include any means of assessing achievement of the objectives:

- True-false tests
- Multiple-choice test
- Essays
- Book reports
- Lab reports
- Observational records
- Simulations
- Anything which will provide a numerical index of performance

Tests designed to measure each objective must be rated at the same level on the taxonomy. In other words, if an objective is rated at the application level, all tests must also be rated at the application level.



PRE-TESTS indicate the students' *prior* mastery of the package objectives. If the student can achieve an objective, then that objective should be skipped.

- A pre-test could be administered formally or informally.
- *Formal* pre-tests require *actual* assessment of the student.
- *Informal* pre-tests involve only asking if the student can perform some specified task. If the student answers "no" then instruction will be provided.

SELF-ASSESSMENT TESTS are also referred to as curriculum imbedded tests or progress quizzes. These tests are meant to inform the students of their progress through the package. Answers to these tests are provided within the package and, based on the score, indicate whether the student should continue to work toward achievement of the objective.

POST-TESTS provide the final assessment within the package. Reflected in the post-test are all of the objectives. Mastery of the post-test is probably assured if the student has done well on the self-assessment tests.

STEP 5.0 Select Teaching/Learning Strategy

Teaching/learning strategies are selected on the basis of desired student responses indicated in the performance objectives. *Strategies* include all *patterns of grouping* procedures: large group, small group, independent study, student-to-student interaction, student-to-instructor interaction, and student-to-media interaction as in programmed instruction.

STEP 6.0 Select Presentation Media

Media include all methods of communication--from the live spoken word to computer-assisted instruction. Media may be selected from commercial sources or you may produce your own. If you decide to produce your own media, re-examine the constraints identified in Step 3.0.

Instructional media act as stimulus vehicles to present the subject matter. The same subject matter can be presented in a variety of forms. If you wanted students to be able to identify and distinguish between various forms of organisms you could: show a film; refer the student to sections of books; provide pictures with accompanying audio tapes; provide the student with pictures and accompanying mimeo notes; develop a 35mm series of slides and accompanying audio tapes. Media alternatives include:

- Film alone
- Film accompanied by outline notes
- Filmstrip alone
- Filmstrip and audio tape
- Filmstrip and audio tape to outline notes
- Audio tape alone
- Audio tape accompanied by outline notes
- 35mm slides and audio tape
- 35mm slides and audio tape and outline notes
- Television alone
- Television and outline notes
- Live lecture
- Live lecture and overhead projections or 35mm slides
- Live lecture and overhead projections or 35mm slides and outline notes
- Photographs
- Blackboard
- Flip charts
- Models
- Any combination of the above

STEP 7.0 Assemble The Learning Package

When assembling the final package the instructor should keep a number of things in mind:

1. Include a note to the potential instructors which contains as many suggestions as possible for using the module. If possible, the particular module's place in the curriculum sequence should be identified.
2. Include a note to the potential student users explaining exactly *how* they are to use the module and *why* it is important to achieve the objectives of the module.
3. When writing your activities and referring to specific films, film-strips, audio tapes, textbooks, etc., give *exact bibliographic entries* so that materials can be purchased.
4. *DO NOT* copy from workbooks or textbooks without written permission from the publisher. If you paraphrase any author's work, give due credit in footnote form.
5. Include as many *information sheets* as necessary to achieve the objectives. Information sheets should be listed under activities and referred to by *exact page*. Information sheets could include summaries, essential information or supplementary information.

STEP 8.0 Field-Test The Package

The completed package should be field-tested with a few students who represent the user population—two are often sufficient. Note carefully how they work through the package, and record any of their questions indicating areas of confusion or ambiguity which might exist. If possible, have a small portable tape recorder available and tape all questions and comments. After they complete the package, interview the students in depth to determine their attitudes and suggestions for improvement. During the field-test the following questions should be addressed:

1. Were the students able to achieve the performance standard indicated in the T.P.O.? Was there a significant gain between the pre-test and post-test scores?
2. Were there any problems in the sequence of I.P.O.'s?
3. Should more I.P.O.'s be included in the module?

4. Did the students possess the required entry behavior for the module?
5. Did the criterion tests actually measure the level of behavior indicated in the objective?
6. Were the strategies selected appropriate to the achievement of the objectives or should an alternative strategy be selected?
7. Was the content relevant to the objectives and interesting to the students?
8. Were the media alternatives adequate, well developed and interesting to use?

FIELD TEST DATA FORM

Date of first field test _____

Number of students _____

Place of field test _____

Total hours of field test _____

Characteristics of students:

1. representative of the user population _____
2. upper level of user population _____
3. lower level of user population _____

Feedback Technique:

1. observation of students using package _____
2. interview students _____
3. record all questions of students _____
4. pre-test post-test gain score _____

Immediate problems observed:

_____

Major comments of students:

_____

NAME	PRE-TEST	POST-TEST	GAIN

BEHAVIORAL OBJECTIVES NOT ACHIEVED AT THE SPECIFIED PROFICIENCY LEVEL:

_____

ACTION TAKEN:
1. Number of performance objectives re-written _____
2. Number of pre-test items re-written _____
3. Number of post-test items re-written _____
4. Review of entry-level behavior _____

RECOMMENDATIONS: _____

PRE-TEST POST-TEST ITEM ANALYSIS FORM FOR A MULTIPLE-CHOICE TEST?

INTERMEDIATE TEST PERFORMANCE ITEM OBJECTIVE		STUDENT										ALL STUDENTS TOTAL RIGHT	PRE-TEST SCORES
3	1	d	d	d	(c)	(a)	d	d	(c)	d	(b)	6	3
9	2	b	b	b	b	b	b	b	b	b	b	10	1
8	3	a	a	(c)	a	(c)	a	(c)	a	a	a	7	2
4	4	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	10	0
1	5	b	(a)	(c)	(d)	b	(d)	(e)	(c)	(a)	b	3	1
6	6	d	d	d	d	d	d	d	d	(a)	(b)	2	0
5	7	c	c	c	c	c	c	c	c	(d)	c	9	2
2	8	d	d	d	d	d	d	d	d	d	(a)	9	7
1	9	a	a	(b)	(c)	(d)	a	a	(b)	a	a	6	3
4	10	c	(d)	c	c	c	(b)	(a)	c	c	c	7	2
10	11	b	b	b	b	b	b	b	b	b	b	10	4
8	12	a	(c)	(c)	a	(b)	(e)	(d)	(d)	a	(b)	3	0
6	13	b	b	(d)	b	(a)	b	b	b	b	b	8	1
7	14	(a)	c	c	(b)	c	c	c	c	c	c	8	0
10	15	(b)	(b)	d	d	d	d	d	d	d	d	8	2
INDIVIDUAL STUDENT CORRECT		12	10	9	10	9	10	11	11	10	11	106 possib. score 150	28 possib. score 150
INDIVIDUAL STUDENT PRE-TEST CORRECT		0	1	0	3	4	1	2	2	0	3		
INDIVIDUAL STUDENT GAIN SCORE		12	9	9	7	5	9	9	9	10	8		

Review of item analysis table:

1. Circled items are incorrect.
2. Test item #2 was scored correct by *all* students.
3. Test item #3 had three consistently wrong answers. This should be reviewed for possible confusion. Interview the three students.
4. Test item #4 was scored incorrect by *all* students. It is either a poor item or possibly an incorrect measure of objective #4.
5. Only three students scored test item #5 correctly. The incorrect responses were varied. This is obviously a poor test item or an incorrect measure for objective #1.
6. Two test items, #3 and #12, attempted to measure objective #8. Test item #3 is obviously a better measure as seven students scored correctly on it. This also applies to test items #5 and #9 which were designed to measure objective #1.
7. This item analysis form allows you to interpret each student's gain scores between pre-test and post-test and also allows you to judge the validity of each test item.

Questions such as these, with answers based on the performance and observation of students who field-tested the module, can provide valuable information for re-design of the material. Once re-designed, try out the module again with different students who represent the user population. Follow the same procedures suggested in the initial trial, and if necessary, re-design the module a second time.

STEP 9.0 Produce Final Package

How often should a package be field-tested and what constitutes a valid package? Opinions differ on these questions. Some say that 90% of the students should achieve 90% of the objectives while others would temper this to 80%. This author takes the position that if any user population can achieve 80-90% of the objectives, the package is valid; however, this judgment is arbitrary. Please review the section on the establishment of proficiency levels in the section entitled" Establishing Worthwhile Performance Objectives."

The actual time it takes a teacher to develop a validated package varies with each individual. Make no mistake, a great deal of time and effort is involved. The first attempt always seems to take an inordinate amount of time, but as experience is gained, the development time is shortened. It has been the author's experience that the average instructor is required to spend an average of 20-30 hours work learning the technique and producing the initial package. This, of course, depends on the amount of local media production required. The "Package Review Checklist" provides a list of items to consider before production of the final package.

PACKAGE REVIEW CHECKLIST

Listed below are a number of tasks which you should have completed for your package. Review this list and check off each task you have completed before using the package.

1. Do your terminal objectives contain the task, circumstances of assessment and proficiency levels? _____
2. Have you identified ALL I.P.O.'s? _____
3. Has anyone critiqued your objectives for clarity? _____
4. Have you adequately defined the entry behavior _____
5. Have you written pre-test, post-test and self-tests which accurately measure ALL your objectives? _____
6. Have you clearly specified the user population? _____
7. Have you identified ALL constraints? _____
8. Have you presented a rationale for your package? _____
9. Have you identified the place of your package in the total course and/or curriculum? _____
10. Have you classified all of your objectives? _____

11. Have you had your classifications verified by at least two other colleagues? _____
12. Have you identified the structure reflected in your package? _____
13. Have you identified a number of activities which the student will use to achieve the objectives? _____
14. Have you given proper page designations for any activities included in your package? _____
15. Have you provided proper bibliographic references for any commercial media used? _____
16. Have you provided any information sheets for your package? _____
17. Have you provided adequate directions for other potential uses? (administrative suggestions) _____
18. Have you provided adequate directions for the students? _____
19. Have you provided all answers for any self-tests? _____
20. Have you included all field test results in your package? _____
21. Have you designed any interactive media for your package? _____
22. Have you copyrighted your package? _____
23. Have you proofread and edited your package for spelling and grammatical errors? _____
24. Have you obtained copyright release for any commercial materials reproduced for your package? _____

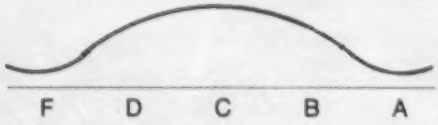
STEP 10.0 Monitor Package Use

Reliability of the package in aiding the student to achieve the performance objectives will be established over time. The monitoring phase will include revisions and update of current subject matter.

	TYPES OF LEARNING PACKAGES
INFORMATION PACKAGE:	These are designed to provide original concepts or supplemental information to texts or other media.
PROCEDURAL PACKAGE:	Explain specific clinical or laboratory procedures. All necessary information is usually included. These are "how to" modules.
APPLICATION PACKAGE:	Show students how to apply principles or concepts.
PROBLEM SOLVING PACKAGE:	Present complex clinical or laboratory problems.
PRACTICE PACKAGE:	Provide additional or remedial practice in skill development.
GROUP PACKAGE:	Designed specifically for small group use.
SIMULATION PACKAGE:	Designed to simulate clinical or laboratory problems.
RESEARCH PACKAGE:	Present research problems for original solutions. These may be used either individually or in small groups.
INDEPENDENT STUDY PACKAGE:	Designed for use by a student. Usually negotiated with the instructor.

IMPLICATIONS FOR TRADITIONAL GRADING

Traditional grading procedure based on an A, B, C, D, F, I, system discriminates against students, as failure is built into it. It is predicated on the bell curve, which presumes failure as well as success.



The grade of each student is dependent on the grades of other students in the same class, since student performance is compared and relative rankings are made among students. The use of learning packages will challenge this system. The student either achieves the performance objectives at mastery level or does not achieve them. How could a student receive a "C" grade? Could a student almost achieve an objective or partially achieve it? What does a "C" really mean? Could a student graduate from your course with a "C" average? If you answered yes, then which objectives don't your students have to achieve? This author recommends that only three grades be used—A, B, I.

A=Outstanding work—maybe the completion of additional modules.

B=Minimal proficiency level.

I=Incomplete—the student needs more time to complete the performance objectives.

CLASSROOM MECHANICS

When instructors first use learning packages, they usually group-pace the students. This results from lack of multiple packages and lack of confidence in using this type of instructional system. As instructors gain confidence and develop more packages, a number of variations occur. Some students are excused from attending certain classes if they demonstrate mastery of the performance objectives. Students work individually or in small groups within the class as the instructor moves about and tutors when necessary. Some instructors offer optional class attendance as all regular lectures are available in the library on audio tape. The instructor holds "office hours" when the class would normally be scheduled. During this scheduled time, students can meet individually with the instructor and discuss their problems. The instructor requires that once students feel they have mastered the performance objectives, they will take a mastery test during the "office hours." A student who performs at the prescribed proficiency level moves on to the next package or attends required lectures.

AFFECTIVE OUTCOMES RESULT WITH PACKAGE USE

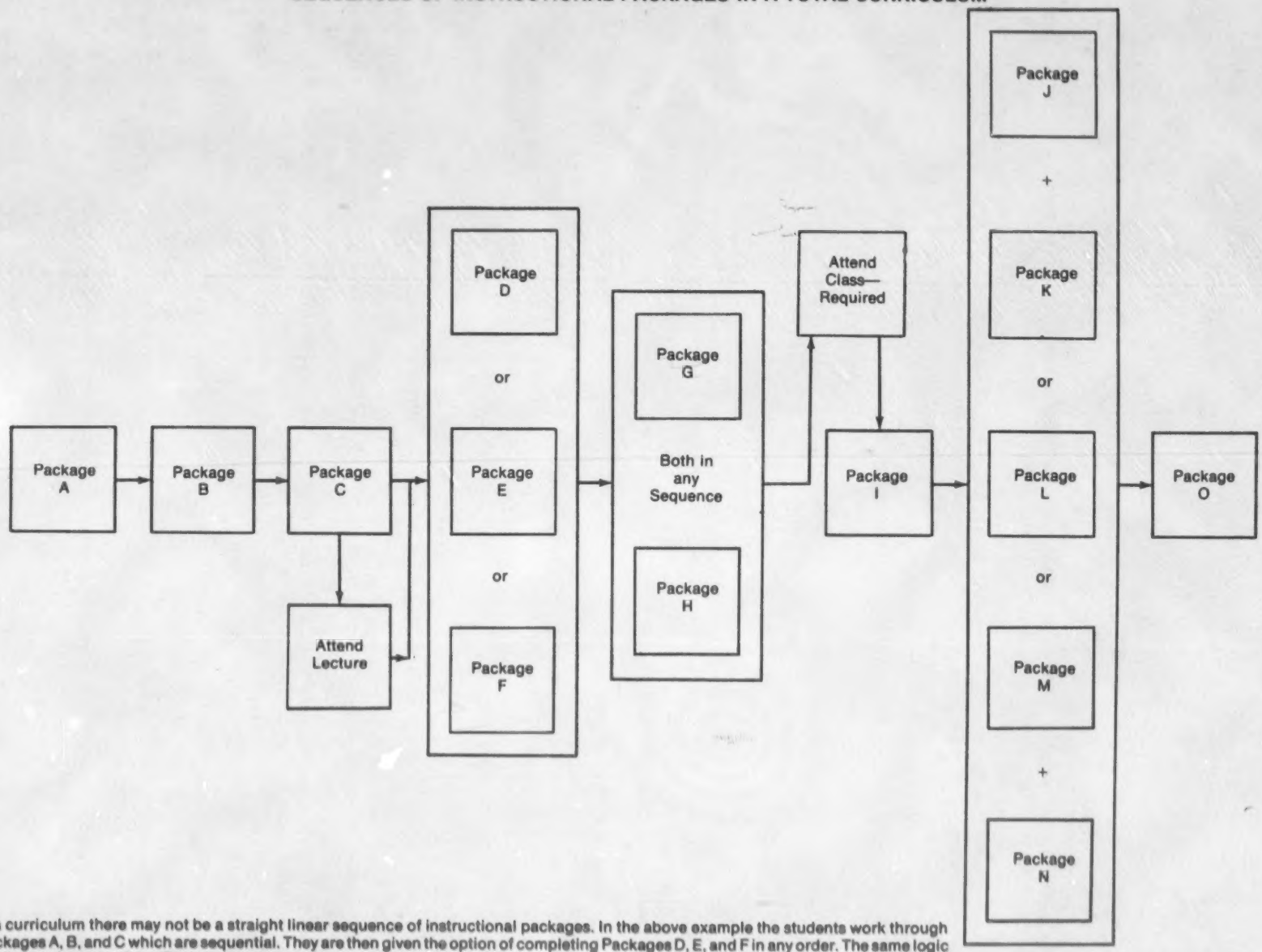
The use of learning packages requires that students accept a great deal of the responsibility for their own learning. They must be self-directing and make many decisions without guidance. Self-assessment of learning progress is implicit in all learning packages. The students must know when they need help and seek it voluntarily. Based on feedback from self-assessment tests, the students must modify their own behavior and seek alternative learning paths. As the students progress and master the performance objectives, a positive academic self-image will emerge. This is particularly important for the student who needs more time and more practice to complete the assigned tasks.

Many learning packages will require students to form small groups to perform certain tasks and will thus encourage group participation and cooperation.

If one of the major goals of Pharmacy education is to help the student to "learn how to learn," then the use of learning packages will reinforce this concept.

One of the biggest problems that students face when first using learning packages is procrastination. Students must learn to use their time effectively and judiciously. Close supervision by the instructor will help to eliminate this problem.

SEQUENCES OF INSTRUCTIONAL PACKAGES IN A TOTAL CURRICULUM



E18

In a curriculum there may not be a straight linear sequence of instructional packages. In the above example the students work through Packages A, B, and C which are sequential. They are then given the option of completing Packages D, E, and F in any order. The same logic applies to the rest of the Packages.

SECTION III
FORMAT FOR THE DESIGN OF STUDENT LEARNING PACKAGES

PACKAGE TITLE _____

_____

_____

COURSE _____

AUTH R(S) _____

_____

DEVELOPMENT DATE _____

DATE OF FIELD TEST(S) _____

PACKAGE JUSTIFICATION _____

_____

_____

_____

_____

PLACE IN TOTAL COURSE OR CURRICULUM _____

_____

_____

_____

GENERAL PURPOSE OF THE PACKAGE*

CHARACTERISTICS OF THE USER POPULATION

1. age level _____
2. achievement level _____
3. background of students _____

4. special motivational factors _____

5. special considerations _____

*Include general cognitive and affective statements if necessary.

DIRECTIONS TO INSTRUCTOR

1. Explain the general package construction.
2. Identify any needed lab or audio visual equipment.
3. State whether every student will need a copy of the package.
4. Explain how to administer the post-test.
5. Explain what to do if the student achieves any of the objectives on the pre-test.
6. Identify any materials or media that the teacher will have to produce.
7. State whether the package is to be used for self-pacing (unlimited time); modified self-pacing (limited time); or group-pacing.

CONTENT ANALYSIS

Select a concept, principle, rule, procedure or technique with which you are thoroughly familiar and break it down into component parts as in an outline. At some point you will have to limit your analysis. Your content segment should take no longer than 2-3 weeks for a student to complete.

MAIN CONCEPT; PRINCIPLE; RULE; PROCEDURE

SUB-CONCEPTS; RULE COMPONENTS; PRINCIPLE COMPONENTS; PROCEDURE COMPONENTS; TECHNIQUE COMPONENTS

DIRECTIONS TO THE STUDENT

1. Explain how to use the package.
2. Emphasize the responsibility of the student to achieve the objectives.
3. Explain what an objective is and how it is used in the package.
4. Explain how the student will be evaluated in the pre-test and post-test.
5. Explain what the self-tests are and how the student should interpret the results.
6. Explain how the student should use the activities—required or optional.
7. Explain the degrees of freedom that the student might enjoy in unlimited self-pacing; limited self-pacing (within a 10 week course structure); group-pacing.

RATIONALE

1. Why should the student achieve the terminal performance objective(s) and competencies?
2. How relevant is the package to professional practice?
3. Are there any practical applications either now or in the future which relate to the skills or information?

PRE-TEST*

DIRECTIONS TO THE STUDENT

OBJECTIVE NUMBER	TEST ITEM

*Be sure that each test item has a number which corresponds to the performance objective it is intended to measure.

ANSWERS TO THE PRE-TEST

DIRECTIONS TO THE STUDENT

1—

2—

3—

4—

5—

6—

7—

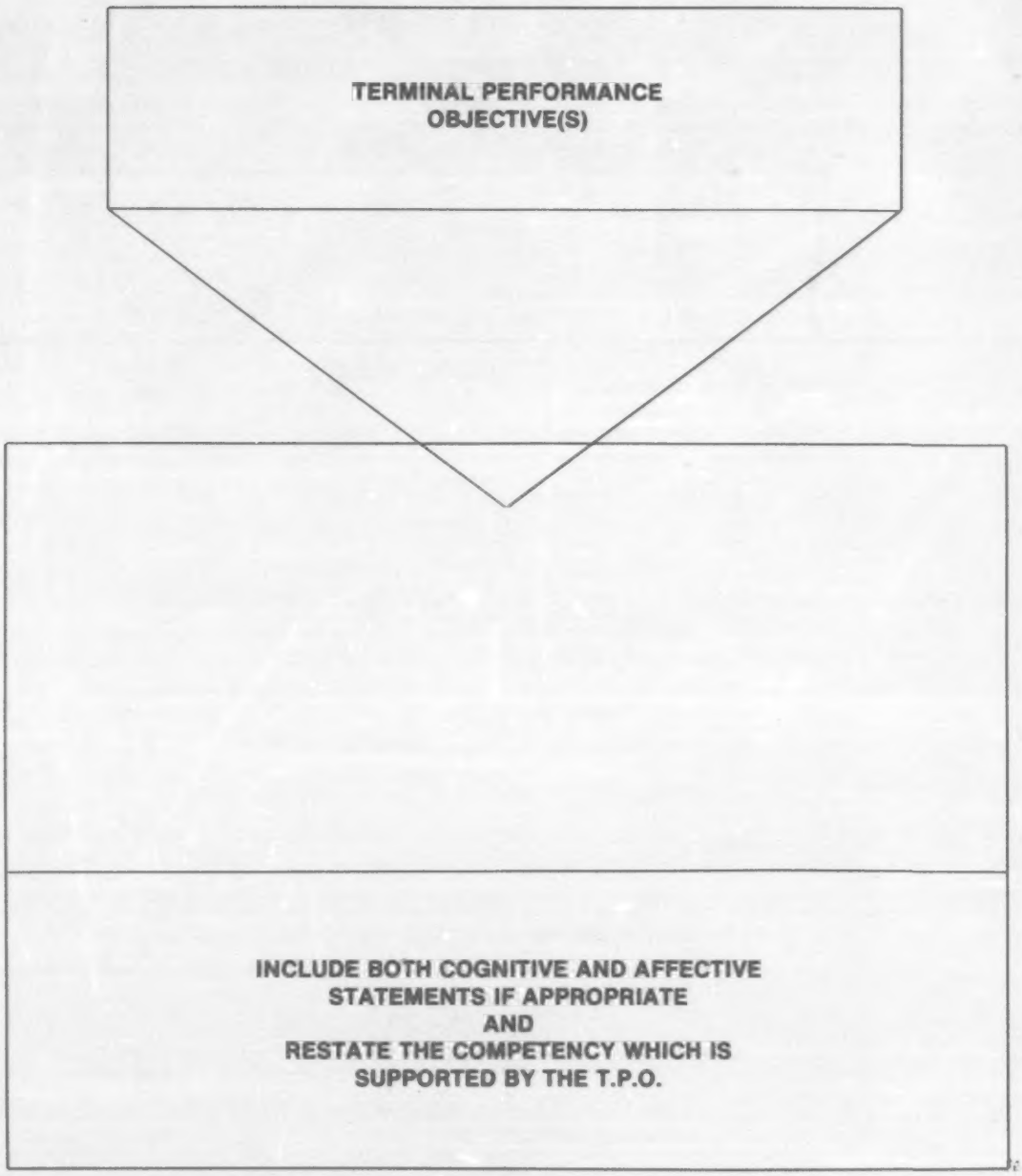
8—

9—

10—

. . . n

Give the student specific directions as to how to take the pre-test and how to proceed.
For example, if the pre-test shows that the student has already mastered certain objectives, you might want to direct him to skip those objectives.
Explain to the student that the ideal pre-test score would be 0% and the ideal post-test score would be 100%.


TERMINAL PERFORMANCE
OBJECTIVE(S)
INCLUDE BOTH COGNITIVE AND AFFECTIVE
STATEMENTS IF APPROPRIATE
AND
RESTATE THE COMPETENCY WHICH IS
SUPPORTED BY THE T.P.O.

INTERMEDIATE PERFORMANCE OBJECTIVE #

_____

_____

_____

_____

_____

_____

_____

SAMPLE DIRECTIONS TO THE STUDENT[1]

Complete the activities listed below in any order. Once you think you have mastered the task, take Self-test #1. If you do not score at least 80% on the Self-test, continue with the activities and take Self-test #2. If you score 80% on Self-test #2 take the Post-test. If you have not scored at least 80% on Self-test #2, see your instructor.

SAMPLE LEARNING ACTIVITIES[2]

1. Study your text pp. 23-24
2. View Filmstrip #1, Frames 1-18
3. Listen to audio tape #6
4. Review the sentence examples in the following texts:
   a. _____
   b. _____
   c. _____
5. Complete exercises 13 and 14, pp. 86-87 in your text
6. Take Self-test #1 and if necessary #2

_____

You should provide a separate sheet for each intermediate performance objective and related learning tasks.

[1]Indicate if the activities are required or optional and if they must be worked in sequence or random order.

[2]For each learning activity identify any special conditions which the student must follow: work alone, form small groups, view films, go to the resource center, work at home . . . . Tell the student where to get all materials and what to do with them. If you refer to specific books or other reference materials, indicate specific pages. If the student is referred to information or activity sheets within the package, indicate the exact page(s).

ACTIVITY SHEET

DIRECTIONS TO THE STUDENT:

What should the student do with the activity sheet:

- memorize it
- work something
- make something
- perform some function in a laboratory
- solve problems

The activity sheet could be composed of exercises or problems to provide appropriate practice for an objective.
The activities could be original or reproduced from workbooks.*

DO NOT include activities that are not relevant for a specific behavioral objective.

INFORMATION SHEET

DIRECTIONS TO THE STUDENT:
What should the student do with the information sheet?
What is the purpose of the information sheet?

The information sheet is included to provide *additional* data for the student. It might provide:

- summary data from a variety of technical sources, thus simplifying the reading.
- explanations of and comments on some reading the student has done
- definitions
- examples
- model problem solutions
- original teacher comments on a skill or concept
- drawings
- pictures or sketches with verbal explanation

It is *not* intended that the student be required *to respond* to an information sheet since the purpose is to provide supplemental data to *already* existing references.

*You should receive permission from the publisher if you reproduce anything. This is particularly true if you intend to copyright your package.

MEDIA SUMMARY SHEET

TITLE OF MEDIUM: _____

DIRECTIONS TO THE STUDENT:

Summary sheets are provided for students so that they can immediately summarize data during or after reading chapters in books; listening to audio tapes or records; viewing filmstrips, films, videotapes or pictures.

Summary sheets might provide written *cues* such as words or phrases that the student is to identify, define and summarize.

STRUCTURED NOTE SHEET

DIRECTIONS TO STUDENTS:

Structured notes give the student an *outline* of a topic and require the student to respond by *filling in* significant words or phrases. The structured note technique can be presented live on overhead projections or 35mm slides. Structured notes may also be presented on audio tape. Significant words and phrases are *repeated slowly* and *frequently* by the instructor so that the student can respond by filling in the blanks. Very little thought is required of the student. Since the purpose is to aid the student in note-taking technique, the objective of the structured note technique is to *focus the attention* of the student; require written response; and provide obvious clues to what the instructor thinks is important during a live or taped lecture. The structured note technique does not require the student to apply knowledge or solve problems.

An example of a *segment* of a structured note exercise is provided on the next page.

EXAMPLES OF A SEGMENT OF STRUCTURED NOTES FROM BLOOM'S TAXONOMY

TAPE # 6

1. Benjamin Bloom's *Taxonomy of Educational Objectives* presents a plan for classifying and defining the steps leading to critical thinking.

2. One of the ways Bloom defined each category was by using examples of _____ which required students to engage in the specified kind of thinking.

3. The word taxonomy refers to a special system of classification in which the classes are _____ and _____ rather than arbitrary.

4. The first category is _____ or memory and this refers to the _____ or remembering of specifics.

5. The second category is _____. The mental process here is changing information recalled or given into a different _____ form or _____.

6. In the process of _____, the third category, the students discover relationships among facts, definitions, values and skills.

7. The fourth of Bloom's major categories is _____. The mental process in this activity is that of using _____ in a particular and concrete situation.

8. _____, the fifth category is defined by Bloom as the process of combining elements in such a way as to constitute a new structure. This category emphasizes _____ on the part of the learner.

INTERACTIVE RESPONSE SHEET

DIRECTIONS TO THE STUDENT

The interactive response sheet is designed to require the student to respond in writing to problems posed live by the teacher or by the media.

The response sheet is a permanent record of correct and incorrect responses by the student and may be used by the instructor as a diagnostic tool.

With the summary sheet or structured note sheet, the student is required to apply principles, rules and concepts.

There are a variety of formats which could be used as interactive response sheets.

Example 1 is taken from a course in fundamentals of Psychology.[1] The student views two series of videotaped lectures which demonstrate certain experimental principles. At various points during the taped lecture the student is asked to apply the principles to unfamiliar situations. The "Cues and Remarks" column provide additional information which would be helpful to the student.

[1]Terman, Michael. *Interacting with Psychology*. (Thomas E. Cyrs, Executive Producer). Boston: Northeastern University, 1971.

Frame 3-The on-line cumulative recorder (continued)

Identify each of the following explanations for the rate of decline as either plausible (P) or not plausible (NP).

_____a. The organism became fatigued after responding for so long.

_____b. The reinforcer became increasingly effective as a function of time.

_____c. The organism was denied reinforcement after the first ten minutes (extinction).

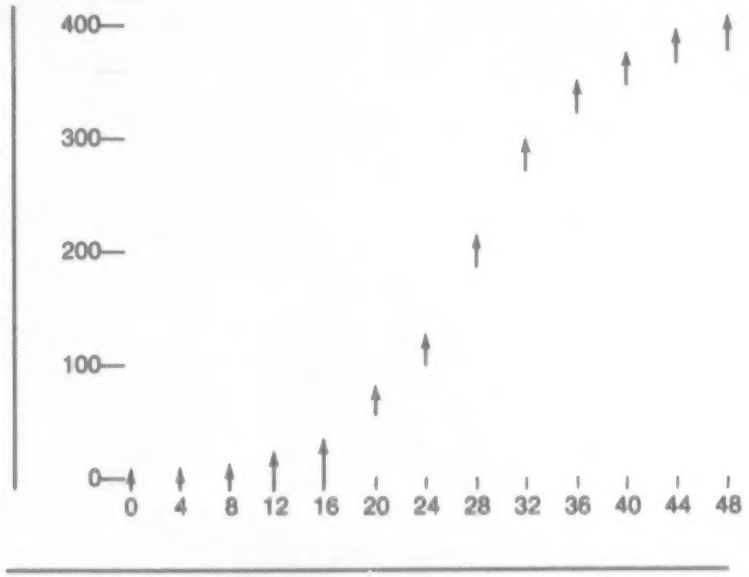
_____d. The organism became nondeprived (satiated) after receiving many food pellets, and the reinforcer lost some of its initial effectiveness.

_____e. The organism was rewarded for doing something else besides the measured response.

_____f. The bar was removed from the chamber, so responding was impossible.

Frame 4-The on-line cumulative recorder (continued)

Complete the following graph. Follow the directions given by your instructor.



SELF-TEST FOR OBJECTIVE(S)

DIRECTIONS TO THE STUDENT:

1. The self-test is meant to provide some immediate feedback to the student indicating to what degree the objectives are being met.
2. The self-test must measure specific intermediate performance objectives.
3. The student should be told which intermediate performance objectives the self-test is measuring.
4. The answers for the self-test might be provided in the package or the student could be directed to obtain an answer sheet from the instructor or at some other location.
5. A *minimum* score on the self-test should be indicated for the student. If the minimum score is not achieved, the student should be directed to review selected activities or complete additional activities.

ANSWERS FOR SELF-TEST

DIRECTIONS TO THE STUDENT

Compare your answers with the correct answers below.

If you did not get at least ---------

correct, review activities ----------

--------and complete activities ----------

---------- ----------.

POST-TEST*

DIRECTIONS TO THE STUDENT:

A post-test does not have to be a paper and pencil test. It could consist of the instructor observing the student performing and then recording the results on a check list.

The post-test could also require the student to make some product or possibly manipulate or operate something such as an instrument in a laboratory.

The performance required in the post-test is contained in the statement of the terminal performance objective.

*Be sure that each test item on the post-test has a number that corresponds to the performance objective that it is intended to measure. Tell the student what to do after he completes the post-test and where to obtain the results.

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PREPARING CLASSROOM TESTS

Paul G. Grussing

INTRODUCTION

In the demanding process of educating a pharmacist, a dominant theme is clearly woven through three years of instruction. Whether teachers contribute to student performance in drug action, drug delivery or professional practice, many strong threads of the theme of QUALITY CONTROL are permanently woven into the student's professional fabric. This chapter is about the kinds of quality-control decisions instructors must make about their contributions to the educational process and about methods for measuring the quality of their products—the students. It introduces the instructor to a set of statistical tools not unlike those used in the areas of production, quality control and research. Practical conventions of many sorts are offered as procedures to reduce measurement error. A list of references is provided for those interested in more specific assistance in classroom testing.

As curriculum change occurs, the classroom test will continue as a prime method of assessing student progress through a unit of instruction. Classroom instructors will be able to select competency-specific or objective-specific items from the test item bank, but will also rely on their own test items for finite measurement of student progress within instructional units.

This chapter is written to help the classroom teacher design, administer and score reliable and valid tests. After studying this chapter, the user should be able to:

1. Define the meaning of the terms "Test," "Measurement," "Evaluation," and "Assessment" as used in the Curriculum Improvement Project;
2. Describe several purposes for tests in general;
3. Describe several purposes for classroom tests;
4. State and apply the principles of norm-referenced testing;
5. State and apply the principles of criterion-referenced testing;
6. State and apply the conept of test error and the principles of reliability theory;
7. Identify and use procedures to improve test reliability;
8. Discuss the concept of test validity and explain the types of validity;
9. Explain how criterion-referenced testing alters test performance as explained in classic reliability theory;
10. Write test items for each format;
11. Identify and correct error-producing problems in test item construction;
12. Select test item formats to supplement the test purpose;
13. Define and calculate item discrimination indices and difficulty levels;
14. Conduct an item analysis; and
15. Describe conventions for assembling, administering and scoring a test.

I. WHAT IS A TEST?

The word "Test" is so familiar to pharmacy faculty and students that time is seldom taken to consider a definition. Everyone knows what tests are and what they are traditionally used for, especially conventional classroom tests.

Consideration of the purposes of classroom tests must follow a definition which is general enough to embrace all of the purposes to be discussed in this chapter. *A test is defined as a systematic instrument for measuring a sample of a student's behavior*. It is *systematic* in methods for generating content from the performance area being measured, in methods of administration and in methods of scoring, interpretation and reporting. It is, like the tools of the bench scientist, a procedure for *measurement* requiring attention to minimizing measurement error. Similarly, depending on the kinds of inference to be made from the student's measured behavior, appropriate *sampling* is essential. And, finally, *behavior* may include manipulative performance (psychomotor behavior) as well as student attitudes (affective behavior).

The terms "Test," "Measurement," "Evaluation" and "Assessment" are sometimes used intechangeably, but clear distinctions occur in the meanings used in the Curriculum Improvement Project. The term "Test" is the narrowest of the three, usually connoting a written set of questions measuring students' knowledge. "Measurement" (sometimes considered to be synonymous with a broader definition of "Test") is a more general term, including procedures other than written tests. Classroom observations, laboratory product inspections, extern performance ratings and term paper reviews are all examples of measurement because, like tests, they all enable samples of the student's behavior to be translated into some quantitative measure. The process of "Evaluation" means the systematic collection of many kinds of useful information (including test and measurement data), followed by the analysis of that information to determine the worth or value of a product or process. In the Curriculum Improvement Project, the terms "Program evaluation" and "Student evaluation" are sometimes used to describe the process and product of greatest interest. However, each College of Pharmacy student is of equal worth or value as a person, and because this sense of "valuing" in connection with students seems inappropriate, the term "Student assessment" seems more properly to describe the multi-observer, multi-method activities which measure student progress against established performance objectives. Student assessment, as it is used in the Project, is synonymous with student evaluation.

II. PURPOSES OF TESTS AND MEASUREMENTS

This chapter is dedicated to the development of classroom tests, but tests and measurements of several kinds aid in at least three types of decision-making elsewhere in the college. These can be classified as: *selection* decisions, *placement* decisions and *hypothesis testing*.

A. Selection Decisions

In the selection (admission) process, more pre-pharmacy applicants occur than available positions in the school. The purpose of the tests and other measurements used in this process is to predict which students are most likely to succeed *in the curriculum*. Two kinds of measures are most useful: pre-pharmacy grades in chemistry and other sciences, and scores in the new Pharmacy College Admissions Test (PCAT). At the present time, no correlations between these unvalidated predictor measures and success in the curriculum are available. There are no measures used for the prediction of success in practice or in other activities in the field of pharmacy.

B. Placement Decisions

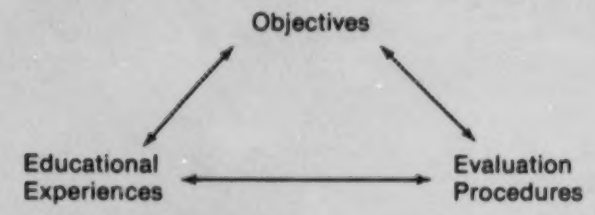
In the placement process, one or more students are confronted with alternative courses of action. Tests may provide data to assist in matching the student with the most interesting and productive educational alternative. "Testing out" of a pre-pharmacy course enables the student to prepare for a special area of interest or to begin required cultural electives.

C. Hypothesis Testing

The hypothesis tested may relate to selection, placement or instructional decisions, or may be conducted only to check on a particular hypothesis. For example Manasse (1974), using a set of personality, interest and values inventories, examined changes in attitudinal patterns of pharmacy students and the impact of classroom teachers and preceptors upon such measured changes. The transition from idealism to realism and the role conflicts suggested by this study have useful decision-making implications for curriculum development.

III. PURPOSES OF CLASSROOM TESTS

Performance objectives, written to guide the instructor in the presentation of knowledge or other learning experiences, also form the framework for what is to be measured. Classroom tests have several purposes, and ach determines the degree to which the performance objectives have been met. A difinite relationship exists between the performance objectives, the educational experiences offered and the classroom tests used to measure student progress. Furst (1958, p. 3) has shown this relationship as follows:



This cyclical model begins with the instructional objectives which form the basis for both the instruction and the tests used. The processes of designing the instruction and developing the tests both serve to clarify and delineate the objectives, perhaps suggesting later modifications in the objectives. Scores on the tests and other evaluation information provide feedback on the instruction's effectiveness upon the student group, thus suggesting changes in instruction as well as providing individual student performance data.

Out of this cyclical model, several purposes of classroom testing for the teacher can be classified. Tests provide: (1) summative[1] data for comparing and reporting differences between student scores, and for comparing student performance with a pre-established performance criterion; (2) formative[2] data to evaluate and improve the effectiveness of instruction; and (3) diagnostic data to compare and assess student strengths and weaknesses.

From the student's viewpoint, classroom tests have several uses. Classroom testing assists the student by: (1) providing feedback on the student's strengths and weaknesses relative to the performance objectives; (2) further delineating the instructor's objectives; and (3) motivating the student by demonstrating that the test represents a good sample of the knowledge or experience provided in the unit of instruction.

A. Two Approaches to Reporting Test Results:
Comparing and Reporting Differences Between Students' Scores.
Comparing Performance with a Pre-established Criterion.

The classic method for reporting scores was an outgrowth of the intelligence testing movement and relies on assumptions of parametric statistics. When individual scores are compared to each other within a group, the approach is called "Norm-Referenced Testing" (NRT). The phrases "This student scored at the 86th percentile" or "The passing score for this license examination is 1.5 standard deviation below the mean" illustrate this common approach. A more recent approach called "Criterion-Referenced Testing" (CRT), recognizes the value of comparing differences between students' achievement or performance, but emphasizes the belief that in many educational contexts, a student should be required to demonstrate that he or she has or has not "mastered" the material or performance (Glaser, 1963). What constitutes mastery varies depending on the "criticalness" of the achievement or performance in question. Mastery of a highly critical performance may require performance at some absolute level. For example, in the prescription dispensing part of the practical examination for pharmacy licensure in Minnesota, the criterion or mastery score is set so that compounding a prescription with an overdose is tantamount to failing to meet the passing criterion. This is a critical performance for which mastery seems appropriate from a public policy standpoint. Other examples of criterion performance involving absolute mastery are safe instrument approaches for commercial aircraft

[1]Summative evaluation refers to the final student evaluation used for reporting the student's grades and making pass-fail decisions.

[2]Formative evaluation refers to the in-process, mid-course evaluation conducted for the purpose of providing feedback to both student and teacher about the student's progress. It is conducted for purposes of instructional improvement and student feedback.

pilot trainees, and the dentistry license examination requirement for preparing a dental surface without penetrating the dental pulp. For less critical performances, a band of acceptable performance may define the lower limits of mastery.

Mastery testing follows the early writings of Carroll (1963) and Bloom (1968) which stated that the degree of student learning is a function of the time spent in preparation. Once a mastery or criterion performance level is set, the comparative level of student performance is de-emphasized as a variable and attention is given to time and the nature of the instruction as variables. The concept is further supported by Bloom et al (1971):

> "Mastery learning can be one of the more powerful sources of mental health. We are convinced that many of the neurotic symptoms displayed by high school and college students are exacerbated by painful and frustrating experiences in school learning. If 90% of the students are given positive indications of adequacy in learning, one might expect them to need less and less in the way of emotional therapy and psychological help. Conversely, frequent indications of failure and learning inadequacy are bound to be accompanied by increased self-doubt in the student."

Although the concept is appealing and logical, evidence of the pathology referred to does not seem evident, nor is there evidence to support 90% as an estimate of the amount of students who may benefit from the mastery approach. Furthermore, the approach may not be universally applicable. The examples quoted above were based on the idea of critical performances, but it has not been established that absolute mastery of all units of instruction is always essential for a student to proceed satisfactorily through subsequent units. Thus, the application of the concept could be selective for less critical units of instruction.

Another comparison can be made by examining the functions of norm-referenced and criterion-referenced tests. Norm-referenced tests are designed to maximize variance in scores so that differences between students may be more easily identified and so that conventional measures of internal consistency will provide useful estimates of test reliability. Norm-referenced tests, with frequency distributions resembling normal distributions, may also be used in the criterion-referenced sense. Examination of criterion-referenced tests reveals that items are not chosen for psychometric properties yielding greatest variance in scores, thereby permitting classic reliability theory to operate. Instead, items are chosen on the basis of their tightly specified representation of a universe of behaviors required for mastery and for ability to distinguish between students who do and do not achieve mastery. Meskauskas (1976) summarizes several methods for setting the criterion score of each item and for an entire test. The methods for setting criterion scores depend upon whether mastery is viewed as a continuously distributed set of performances within a band, the lowest end of which is achieved by a "master" (continuum models) [Nedelsky, 1954; Ebel, 1972; Kriewall, 1972] or whether mastery is defined as an all-or-none, pass-fail definition without an error band (state models) [Emerick, 1971]. While criterion-referenced tests tend to exhibit less variance in keeping with the mastery learning theory, it is possible for a criterion-referenced test to have norm-referenced properties which are useful for observing differences between students. Thus either type of test may have the properties of the other.

Classroom testing approaches will be based upon whether the test purpose is to compare students with each other or to a performance standard and upon the needed degree of self-pacing planned by each instructor. Decisions made by each instructor will involve judgments about the critical nature of the achievement or performance required at the end of each instructional unit. The information required in that decision making might be organized in this fashion.

	Critical Performance	Non-Critical Performance
NRT		
CRT		

If instruction is designed so that time becomes a variable, especially when the terminal behaviors are critical, then criterion-referenced testing should be used in a form which also provides opportunity for normative comparisons. If the terminal performances are not critical and the instruction is designed to hold the time constant, then the advantages of both NRT and CRT should be exploited. Additional comparisons between the two approaches will become apparent in later sections discussing reliability, validity, test construction and item analysis. Most of the discussion will describe classic reliability theory associated with norm-referenced

tests. This is appropriate for the study of criterion-referenced tests, because criterion-referenced classroom tests may take on norm-referenced properties when sufficient test variance exists to apply the norm-referenced estimates of internal consistency. In cases where the variance is too low to permit such application, a formula for estimating internal consistency for criterion-referenced test is provided.

B. Formative Data to Improve the Effectiveness of Instruction:

Usefulness of the test data fed back to the instructor is related to the quality of the tests used. Measures of test quality are referred to as test validity and test reliability—terms which will be discussed in Section IV. Assuming the course objectives are clearly specified and the test is of sufficiently high quality the classroom teacher may rely on test results for answers to the following types of questions:

1. Did the test scores indicate performance below an acceptable level or criterion for each content area measured?
2. Is there a relationship between test performance and the method of instruction used for each content area?
3. Does a uniformly high level of performance in certain content areas suggest not only mastery of that area, but perhaps that less time could be given to instruction? Or would selection of another medium of instruction be more efficient in certain areas?
4. Does student performance indicate a need for altering the sequence of instruction?
5. If a hierarchy of instructional objectives exists, is this borne out by performance in all areas of the test?
6. Is there a relationship between success in parts of this course and success in subsequent units of instruction? Is there a need for criterion-referenced testing in the subordinate units of instruction to increase the likelihood of success in subsequent units?
7. Does performance suggest testing in smaller units to further assess learning in each segment?

C. Diagnostic data to Identify Student's Strengths and Weaknesses:

Diagnostic tests permit the comparison of an individual student's strengths and weaknesses relative to the performance objectives. Such diagnostic tests may also provide data permitting a student to move at a more rapid pace through a unit of instruction, based on demonstrated mastery of certain subject areas. Similarly, entry level characteristics of an entire class may be measured so that instruction can be modified to meet the courses objectives. Such tests may measure terminal performance objectives of a previous unit of instruction. In either case, care should be taken to ensure that each subtest or cell in a diagnostic test is both reliable and valid. These are essential test characteristics to be discussed in the next section.

IV. CHARACTERISTICS OF TESTS

A. Error in Testing:

In defining what is meant by a test, the importance of minimizing test error was mentioned. Error in the process of classroom testing may occur for many reasons. Since any form of error distracts from the purpose of testing, i.e., to measure a sample of student behavior, the identification and control of testing error is essential.

There are three general sources of error: (1) errors within the test, (2) errors occurring as a result of the test administration procedures, and (3) errors occurring because of variables within the student. Some examples of errors within the test are:

- Ambiguity in the instructions for responding.
- Ambiguity in the item or response of the questions.
- Consistently difficult tests, causing the student to operate at the guess level.
- Improper sampling of test questions from the domain of knowledge to be tested.
- Extremely short tests.
- Inadequate testing time.
- Student scoring errors.

Some of these test errors may be attenuated by proper test administration procedures. Inept test administration may introduce yet additional error into the test performance. Errors which may be attributed to faulty test administration may be due to:

- Student misunderstanding of test instructions (either oral or written).
- Student misunderstanding of response recording procedures.
- Student difficulties in judging the amount of time needed to complete the test, or
- Physical distractions in the test environment (temperature, sound, ventilation, etc.).

Among the most difficult sources of test error to deal with are the variables attributable to the individual student taking the test. These variables are mentioned as a possible explanation for the test-taking behavior of single students or groups of students, and include:

- Physiological variables. (On a given day a student may be fatigued, ill or may experience good or bad luck in guessing at unknown questions.)
- Test anxiety. (Especially before critical and comprehensive tests.)
- Individual differences. (Each testing experience measures not only the content of the classroom learning experience, but all of the prior knowledge, skills and problem-solving ability acquired in the student's lifetime.)
- "Test wiseness." (Students with experience in responding to specific test formats are apt to score higher than students for whom the format is a new experience. Provision of examples within the test and prior use of the format serve to reduce this source of error.)
- Student motivation. (Differences in motivation might explain differences in scores between A/N and S/N groups, or differences in performance on tests of differing weight in the course grading formula.)

B. Errors and Reliability Theory.

(1) Reliability Theory.

The meaning of the term "Reliability" in educational measurement is not unlike the meaning understood by pharmaceutical scientists. A conceptual definition suitable for both disciplines may be "the degree of consistency between two measures of the same thing." Reliability, as used in classroom testing, is based on a concept involving components of a student's observed score. If the observed score (X) is thought of as consisting of a "true score" (T) plus an "error score" (E), then

$$X = T \text{ plus } E$$

The true score (T) is conceptualized as the average of an individual's scores on a test over many repeated administrations of the same test. The observed score on each of these measures may at some times be higher than the true score, and at some times lower. This true score concept is a hypothesized property of a test and would not operate except in theory, since repeated scores by the same student on the same test over time would show effects of learning from previous administrations of the test. The concept is useful if the error scores are assumed to occur randomly and if they have no relationship to the hypothesized true score.

Using this concept of the composite of an observed score, the variance of a classroom test can be expressed as:

$$Sx^2 = St^2 \text{ plus } Se^2$$

where Sx^2 is the variance in the class' observed scores,
St^2 is the variance in the class' true scores, and
Se^2 is the error variance in the class' scores.

Reliability then is defined as the relationship between the true score and observed score variances.

$$r_{xx} = \frac{St^2}{Sx^2} \qquad \text{F.1}$$

The term "r_{xx}" expresses a Pearson Product Moment correlation of the same trait or performance, and formula _____F.1 shows how the reliability expresses the observed score variance in terms of the amount of true score variance (minus error). By rewriting algebraically, a more common definition of reliability can be expressed:

$$r_{xx} = 1 - \frac{Se^2}{Sx^2} \qquad \text{F.2}$$

(2) Standard Error of Measurement.

The term "Standard Error of Measurement" is common in the pharmaceutical sciences and is useful here for expressing the amount of error which occurs in an individual's score, based on data from class scores. It may be conceptualized as the standard deviation of a student's observed scores (if the same test were administered many times) about the student's true score on the same test.

$$Se = Sx \sqrt{1 - r_{xx}} \qquad \text{F.3}$$

Note that this is an estimate obtained from *group* data. It should not be used for estimating an individual's true score, but helps express the amount of error in a test by delineating a band of measurement around the true score. An example of the use of the standard error of measurement occurs in the application of passing scores established by the Minnesota State Board of Pharmacy for its internship program. Suppose a post-graduate intern scores 73% on the internship post-test, and the Board's cutting score for post-graduate interns is 75%. Since internship credit is not given to interns who fail the post-tests, care is taken to apply a band of measurement determined by the error of the test. If the reliability for a given test is .82 and its standard deviation is 5.9, then in order to be 95% confident that the individual's true score may lie above the passing score, the standard error is calculated:

$$Se = 5.9 \sqrt{1 - .82}$$
$$= 2.5$$

Thus the Board can be 95% confident that the intern's true score lies between 68% and 78% (observed score "+" 2Se) and applies this band to the cutting score, permitting the intern to pass the exam.

(3) Estimating an Individual Student's Score.

The phenomenon of "regression toward the mean" is used in this estimate. If the student's score is above the mean we may assume that he or she benefitted from positive errors of measurement. If the score lies below the mean, negative errors were operating. A formula for estimating an individual's true score is as follows:

$$Te = r_{xx} (X - \bar{X}) \text{ plus } \bar{X} \qquad \text{F.4}$$

If, in the above example, the mean score for the group of post-graduate interns was 84%, the intern's estimated true score would be:

$$Te = .82\ (73–84)\ \text{plus}\ 84$$
$$= .82\ (-11)\ \text{plus}\ 84$$
$$= -9.02\ \text{plus}\ 84$$
$$= 75$$

C. Estimating Reliability.

The term r_{xx}, denoting the test reliability, has been used in formula _____F.3 to determine error of measurement. Several methods of estimating reliability of a test will be discussed with particular emphasis on estimates of value to the classroom teacher:

(1) The coefficient of stability.
(2) The coefficient of equivalence.
(3) The coefficient of stability and equivalence.
(4) Measures of internal consistency:
—"Split-half" coefficients.
—Kuder-Richardson estimates.
—Coefficient Alpha.

(1) Measures of Stability.

A coefficient of stability is taken by applying a Pearson Product Moment Coefficient to repeated measures of the same test over time. Often called a "test-retest" estimate of reliability, the method is essential when psychological traits are measured which are believed to be relatively stable over long periods of time. The method is of less value in designing quality classroom tests. The coefficient would be affected by the amount of time between tests, memory effects from the first test and other intervening variables including learning.

(2) Measures of Equivalence.

Tests were defined in Section 1 as measurements of samples of students' behavior. By administering two equivalent forms of the same test, a coefficient of equivalence may be calculated which can be interpreted as a measure of the effectiveness of the sampling of behaviors in both tests from the universe of behaviors the tests purported to measure. In the construction of the two equivalent (sometimes referred to as parallel) forms of the tests, extreme care must be taken to ensure similar statistical properties such as the test means, standard deviation and test item difficulty levels, equivalent content for test items, equal format and test length. The utility of well-designed parallel forms of tests is most evident in pre- and post-testing to measure performance at the beginning of instruction and then to measure gains in learning. Methods for collecting and comparing the required statistical data for parallel form construction are discussed in Section VII.

(3) Measures of Stability and Equivalence.

When psychological constructs are to be measured by tests offering the most rigorous qualities of reliability, combined methods are used. Forms A and B of the same test (equivalent forms) are administered at one time. Then, form A is repeated (A2) at an appropriate time to test the stability of the instrument over time. A correlation of form A2 with form B is calculated, usually showing values lower than from the other two coefficients which may be calculated.

(4) Measures of Internal Consistency.

In the typical classroom situation the teacher does not always have the time to prepare two equivalent forms of the same test, particularly for shorter units of instruction. Yet, reliability estimates are very useful and, fortunately, are possible using one of three procedures (2 of them manual and 1 using the computer).

The "Split-half" method of estimating reliability is similar to the equivalent forms method, except only one test is prepared. If the test is "split" by some means, usually "odds-evens," a correlation coefficient may be computed for the two halves of the test. However, since this correlation is based on only half of the test length, its reliability will be lower than if the reliability were determined by another method. Consequently, a "step-up" or correction factor is applied to restore the reliability to an estimate of the whole test. The Spearman-Brown Prophecy formula is used:

$$r_{xx} = \frac{2\, r_{\frac{1}{2}\frac{1}{2}}}{1 \text{ plus } r_{\frac{1}{2}\frac{1}{2}}} \qquad \text{F.5}$$

where r_{xx} is the estimated reliability of the whole test and $r_{\frac{1}{2}\frac{1}{2}}$ is the estimated reliability of the half-tests. Suppose two halves of a Medicinal Chemistry test showed a correlation of .68 ($r_{\frac{1}{2}\frac{1}{2}} = .68$). Then r_{xx} for the entire test could be calculated as:

$$r_{xx} = \frac{2\ (.68)}{1 \text{ plus } .68} = \frac{1.36}{1.68} = .83$$

Measures of internal consistency are designed to compare the consistency of item performance to the overall performance of the test. The Kuder-Richarson formula 21 (KR21) obviates the necessity of splitting the test and is easily calculated, based on the test means and standard deviation. It represents the average correlation from all possible split-half combinations and estimates. It assumes that the test is homogeneous. In psychological testing, a test must be homogeneous in terms of a single trait which all of the test items are designed to

measure. In classroom testing the test content should be relatively homogeneous; the formula works especially well if all test items are of equal difficulty and if performance on individual items have a direct relationship to overall performance. The formula is given as:

$$r_{xx} = \frac{n}{n-1}\left[1-\frac{\bar{X}(n-\bar{X})}{nSx^2}\right] \qquad \text{F.6}$$

n = number of test items
X = test mean
Sx^2 = test variance

Another version, the KR20, is more sensitive to tests in which items may be of differing difficulty levels. It is the basis for the reliability calculated in the statistical package for test item analysis described in the Appendix. The formula for this version is:

$$r_{xx} = \frac{n}{n-1}\left[1-\frac{\Sigma pq}{Sx^2}\right] \qquad \text{F.7}$$

p = proportion of students answering an item correctly
q = proportion of students answering an item wrong
The product of p X q is summed over all test items
When individual items cannot be scored dichotomously ("O" for a wrong response, and "1" for a correct response), the Coefficient Alpha formula is useful and easy to use in the classroom setting. It is like the KR21 formula except that the variance in response to single test items (which may have a range of response values) are summed across the entire test. This permits the estimation of r_{xx} for short-answer tests or essay tests. The formula is represented as:

$$= \frac{n}{n-1}\left[1-\frac{Si^2}{Sx^2}\right] \qquad \text{F.8}$$

Si^2 = the variance in single item response

INTER-SCORER RELIABILITY

The advantages and disadvantages of "subjective" or essay tests are discussed in Section 6. Rater error is spuriously high in these kinds of tests and can be examined if scores by two or more raters are correlated. This correlation estimates the reliability of the single rater's scores. If the two raters' scores are averaged, their combined reliability can be estimated using the "step-up" formula given in formula F.5.

SOME PRACTICAL CONSIDERATIONS IN ENSURING RELIABLE TESTS

How reliable should a test be for use in the classroom? There are no universally accepted guidelines for the classroom teacher. A useful rule-of-thumb is that tests with reliabilities below .65 probably should not be used for individual pass-fail decisions, but could be useful for group decisions involving feedback for modification of instruction. The teacher should strive for reliabilities in the range of .80 and .85 or higher in order to increase consistency and small standard errors of measurement. A word of caution is in order at this point. It is possible to develop classroom tests with high reliability which may not adequately sample the knowledge or behaviors contained in the instructional unit. Moreover, it is possible that both the test and the instructional content may not relate directly to the hierarchy of behaviors involved in pharmacy practice. A reliability of .96 on a final examination in an astronomy course does not furnish evidence that the test measured knowledge or behavior necessary for subsequent units of instruction or for actual pharmacy practice.

When a test is demonstrated to be reliable, it answers the question "Will the test consistently produce the same measurement results?" An equally important question relates to the discussion in Section IVD, "Does the test measure what it is supposed to measure?" Answers to both questions are essential for effective classroom testing. Some practical rules-of-thumb for increasing reliability of a test include:

1. Maintain an item difficulty level in the range of .4 to .7. This maximizes the variability among scores. See Section VIIB.
2. Avoid subjective scoring methods.

3. Consider the homogeneity of the group being tested. As formula _____F.2 indicates, the observed-score variance in the denominator decreases with homogeneous groups, thus lowering overall reliability.
4. Avoid speed tests. Tests are called speed tests if nearly everyone gets every attempted item right, but no one has enough time to complete all of the test items.
5. Keep the test as long as possible, consistent with the time allowed. The predicted reliability of a longer version of a test can be obtained by the formula:

$$r_{xx} = \frac{Kr}{1 \text{ plus } (K-1)\ r} \qquad \text{F.9}$$

   r_{xx} = the reliability of the longer test
   r = the reliability of the shorter test
   K = the ratio of number of items in the short and long tests

   This "step-up" formula assumes that the items added will be equivalent to those in the original test.
6. Use test items which permit rapid and efficient measurement of the knowledge or skills being measured. Unless problem-solving is a test objective, limit the content of test items to a single concept or function.

D. Test Validity:

"Does the test measure what it is supposed to measure?" The term "validity" answers this question, but in order for a test to be valid, it must first be reliable. A pharmaceutical balance cannot be expected to provide an accurate and "truthful" (valid) measure of a prescription ingredient if it cannot do so consistently (reliably) over repeated weighings. Note, however, that a balance could consistently (reliably) overweigh or underweigh each load. In this case, the balance would be reliable but not valid. Reliability is a necessary condition for validity, but not a totally sufficient condition to ensure validity.

Validity is described in at least four ways by educational measurement specialists, each explaining a special kind of accuracy to be possessed by the test.

(1) Content Validity.

Content validity describes how effectively the test samples the universe of knowledge and behavior in the unit of instruction. No mathematical formula exists for estimating the degrees of representativeness of the universe, but procedures for specifying content are discussed in Section V. Establishing content validity is purely a judgmental process, aided by systematic definition of domains of testable behaviors from the universe being studied. High quality of content validity is absolutely essential in order to make proper inferences about the students' performances based on experiences sampled in the test.

(2) Face Validity.

Face validity refers to the degree of "content-relatedness" as perceived by the student. If the test appears to be effectively measuring the course content, it is said to have face validity. No precise measure for this form of validity exists, but high content validity serves to assure the test-takers' perceptions of face validity. The face validity effect of testing on students is an important motivational factor in both student learning and in test-taking performance. Nothing is more devastating to the learner than the confused and hostile feelings generated by tests which are obviously not content valid in the students' perception. High face validity is essential to both instructor effectiveness and to student motivation.

(3) Criterion-Related Validity.

The question to be answered by measures of criterion-related validity is "How well can the test predict success in a subsequent learning experience or in some real-world practice performance?" Pearson Product Moment correlations are used to describe the relationship where

r_{xy} is the correlation between some predictor test (x) and a criterion measure (y).

Obviously, the usefulness of such a coefficient depends on the quality of both the predictor (x) and criterion measure (y). Establishing the predictive criterion-related validity of a final examination in organic chemistry by correlating it with student grades in a subsequent Medicinal Chemistry course is one rather short-range

application. Measuring the ultimate criterion of effective practice is more difficult and will depend on establishment of measurable performance criteria. At least two characteristics of criterion measures are required for effective predictive validity: (1) the predictor measure should be relevant, i.e., content-valid, to real world criterion activities, and (2) both measures must be reliable. An index of predictive validity is limited by the reliabilities of the respective measures as follows:

$$r_{xy} \leq \sqrt{(r_{xx})\ (r_{yy})} \qquad \text{F.10}$$

Thus, if the predictor test had a reliability of .78 and the reliability of the criterion measure was .81, the predictive validity coefficient could not exceed $r_{xy} = .79$.

Because administration of criterion measures is often expensive and time-consuming, a proxy approach to predictive validity is often utilized. When a proxy measure is administered instead of the true criterion measure, its value is measured in terms of being a substitute for that criterion measure. The coefficient thus expressed is referred to as a measure of concurrent validity—a form of criterion validity, but a proxy measure for a more expensive method of gathering criterion data from which to make predictions.

(4) Construct Validity.

Teacher-made classroom tests are not designed to exhibit construct validity. This concept answers the question "What basic psychological trait does the test measure?" If, in developing performance rating scales for assessing pharmacists' practice behaviors, we discover that a cluster of rating scale items for measuring communication skills appears to show unique and different scores for a group of pharmacists, we may assign a theoretical contruct (say, "assertiveness") to that measured cluster of similar performances. Through sophisticated validation procedures such as factor analysis and convergent and divergent validity studies, the instrument measured and observed behaviors of pharmacists for the assigned trait can be tested and studied.

E. Reliability, Validity and Criterion-Referenced Testing:

For units of instruction in which clearly specified performances must be attained before the students can effectively proceed into the next unit of instruction, the criterion-referenced testing approach discussed in Section 3A is most appropriate. Care should be taken in the analysis of such criterion-referenced tests for reliability. The formulas shown in formulas _____F.6, _____F.7 and _____F.8 are not appropriate when the tests exhibit low variance in scores. These three formulas are based on normal or nearly normal distributions of scores. Criterion-referenced scores should be higher (if the instruction is effective) and much lower variance among scores should be exhibited. Consequently, if reliability estimates are to be used, they should consider the variance around the desired criterion score, rather than around the test mean. A useful formula for expressing test reliability for criterion-referenced tests has been developed by Livington (1970). In this formula, the variance around the criterion score, rather than around the mean, is used to calculate reliability. If the criterion score is the mean, then Livingston's reliability estimates are the same as when calculated by formulas _____F.6, _____F.7 or _____F.8.

$$r_{cc} = \frac{r_{xx}\ Sx^2 \text{ plus } (\bar{X}-C)^2}{Sx^2 \text{ plus } (\bar{X}-C)^2}$$

r_{cc} = the criterion-referenced reliability
X = the test mean
C = the criterion score
Sx^2 = the test variance

Because of the extra time needed to estimate the reliability in this fashion, classroom teachers who rely on criterion-referenced tests should emphasize a low standard error of measurement plus well-defined item-generation rules to ensure content validity. Instructors should not be discouraged if low reliabilities occur using classical reliability estimates. Validity, not classically estimated internal consistency, is the most important single factor in a classroom test, and proper sampling of the universe of content is the critical factor in enhancing validity.

V. PLANNING THE TEST

A. The Test's Purpose(s):

In Section I, several purposes for classroom tests were discussed. These should be reviewed before proceeding. Ask "Why am I testing?" before "What am I testing?" Four purposes of testing were discussed.

1. Comparing and reporting *differences* between students' scores.
2. Comparing student performance with a predetermined *criterion*.
3. Collecting formative data to *improve* the effectiveness of *instruction*.
4. Collecting *diagnostic* data to identify students' strengths and weaknesses.

Your tests may serve all of these purposes at the same time—they are not mutually exclusive. Probably, one of the purposes is paramount; it should, therefore, affect your selection of test item format.

B. The Test Blueprint—Enhancing Content Validity:

Ideally, the test is prepared before the instruction. Since both the test and instruction are based on the course's objectives, all areas of instruction should be covered. Table 1 shows a blueprint for systematically sampling test items from the universe of objectives or content. It may not be possible to plan test items for every cell in the matrix. For example, objectives may be hierarchical, and final examinations may be based mainly on the terminal performance behaviors specified in each objective. Typically, more cells in the knowledge column are filled than from higher performance levels—comprehension, application and problem solving. The grand total is the number of items in the test. The total number of items to be assigned to each objective or content area will be determined by the relative emphasis placed on each area in the objectives and in the classroom. It is helpful to begin the blueprint process by assigning weights in the right hand Total column before completing the balance of the blueprint.

TABLE 1

A TWO-WAY BLUEPRINT FOR PLANNING
A FINAL EXAMINATION IN PHARMACEUTICAL SCIENCES

Course Objectives (if not specified, use content outline)	*Level of Performance Expected*				
	Know-ledge	Compre-hension	Appli-cation	Problem-Solving	Total
1.					
2.					
3.					
4.					
5.					
.					
.					
.					
n					
TOTAL					

VI. TEST ITEM FORMATS

A. The Essay vs. the Objective Test:[3]

The essay examination remains in popular use probably because it is easy to prepare and because its users believe that it is essential for the measurement of higher order analytical and problem solving abilities. Doubtless an essay test, say of five discussion questions, is easier to prepare than a 100-item multiple-choice counterpart. But the trade-offs are evident, as our discussion will indicate. Nor does evidence exist that only the essay test must be used to measure effectively higher order and more complex performances.

B. Some Advantages of Essay Tests:

1. The development of writing skills enabling an aspiring professional to communicate clearly in well-organized form is an obvious educational objective. Writing essay answers to properly structured questions can be a useful learning experience. Care should be taken, however, to offer practice in this test format so the test experience can maximize the student's writing skills, rather than become a source of test error because the student can not write effectively. If the instructor wishes to select this format as a learning experience, he should also assume the responsibility to ensure that it is not the student's sole learning experience in writing skills.
2. Ease of preparation is clearly an advantage of this format. Too often, however, essay examinations are "thrown together" at the last minute, and the suggestions in Section VID are not followed.
3. Students may express their feelings in essay examinations. Where change in affective behavior is included in course objectives, carefully selected questions designed to elicit student values in their responses may be useful.[3]

C. Some Disadvantages of Essay Tests:

1. Essay tests generally do not permit thorough sampling of the behaviors included in the course. Objective tests with more test items requiring less time to respond to each item are more efficient.
2. Essay tests are generally unreliable and subject to rater bias such as halo effect (as when high performance in one area is generalized to the rating of other areas), leniency effects (as when a rater scores all students consistently high), and central tendency effects (as when a rater scores all students about the same).
3. Essay tests require more time to grade, especially if procedures to improve reliability are used.
4. Measurement of students' writing skills may confound the test results from the content standpoint unless such measurement is the primary objective. Aside from increased opportunity for bluffing, the most articulate students may approach the test with more confidence (and better performance) than other students with the same ability to comprehend and to apply the learned material.

D. Some Guidelines for Essay Test Preparation:

1. If the instructor's purpose is to measure recall of knowledge, abandon this format.
2. Select the essay format only when students' writing skills are well-established as previously determined by diagnostic testing and are part of the course's objectives.
3. Select the essay questions to represent course objectives and content as broadly as possible. This may involve focusing the questions on smaller segments of knowledge and behavior.
4. Structure the questions to elicit either cognitive responses or affective ones. Do not allow opinion to be substituted for application of organized facts unless opinions are the response desired.

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[3]Because this classification may imply that essay tests can never be "objective," some writers prefer the term "constructed response" to describe essay and short answer tests, and the term "selected response" to describe true/false, multiple-choice and matching test formats.

5. Steer the student in a general way toward the response desired. Use of expansive, open-ended questions generally does not elicit the type of content-valid response needed. Without some directions delimiting the students' response, validity is lost. Consider limiting the topic, length of response, time allowed per question, sources used or style of response. The following phrases may be helpful:
   - Outline the procedures you would follow to . . .
   - In your own words, explain the . . .
   - In _____words or less, discuss the strengths and weaknesses of . . .
   - Discuss _____from the following perspectives: _____, and _____.
   - In what class of drugs would you place _____. Explain your choice.
   - Why does the . . .? Support your answer with at least reasons.
   - Compare the _____ and the _____ . . .
6. Suggest the weight or value to be attached to the question as well as the approximate amount of time which should be devoted to answer the question.
7. Prepare your key before administering the test. Actually outline the elements of an acceptable answer and assign points to each keyed element. Also cite how the answer should be organized.
8. Share your performance expectations with the student before administering the test. Are you critical of spelling errors? How will grammatical usage affect your grading and what emphasis is to be placed on clarity of expression?
9. Avoid giving students a choice of questions for discussion. This reduces test reliability because it provides uneven sampling and offers a chance for questions of unequal difficulty.
10. When grading an essay test:
    - Refer to the key.
    - Maintain student anonymity.
    - Read a sample of the tests for purposes of anchoring the range of quality in the responses.
    - Score one question at a time across all tests.
    - Score all responses to each question at a single sitting.
    - Do not confuse style with content.
    - Arrange for an independent scoring by another rater.
    - Give useful written feedback on the test.
    - Analyze the responses for patterns of errors which might be considered in improving future instruction.

E. Why Multiple-Choice Tests?

Several advantages of this format make it very popular.

1. The multiple-choice test is efficient. That is, students may be tested on a relatively large content sample in a short period of time.
2. The multiple-choice test is easy and quick to score; machine scoring may be easily employed.
3. The multiple-choice item can measure more than recall of information, provided the instructor designs analytical and problem-solving skills into the test item format.
4. Multiple-choice tests are more reliable than either essay or true/false tests.
5. By increasing the number of responses to 5, susceptibility to student guessing is reduced to a 1 in 5 chance (as opposed to a "50-50" chance in true/false items).

The main disadvantage of multiple-choice tests is obvious and represents the "trade-off" in deciding between essay and multiple-choice tests. Essay examinations are thought to be comparatively easy to construct, but difficult to score. Multiple-choice tests are difficult to construct, but easy to score.

A second disadvantage is the ambiguity found in many instructor-prepared multiple-choice tests. The ambiguity, however, is neither due to the attributes of the multiple-choice test nor to the instructor's content expertise, but solely to the lack of the instructor's item-writing experience.

F. Guidelines for Multiple-Choice Tests:

The multiple-choice test item consists of a stem, a correct response and three or four incorrect responses (distractors). The stem of the item presents the main elements of the problem to the student. It sets a frame of reference for the choice of the correct response.

1. All of the responses should flow in a grammatically correct manner from the stem when an incomplete statement format is used. For example:
   The reliability coefficient of a test may be improved by
   - __A. designing criterion-referenced items.
   - __B. decreasing the test length.
   - X C. increasing the test length.
   - __D. making the test content more heterogeneous.

2. The responses should be homogeneous in both their content and in their length. Consider a poor example:

   Phenothiazine-type drugs are dispensed in
   - __A. aerosol foam.
   - X B. amber containers.
   - __C. optometrist's offices.
   - __D. compliance with the state controlled substances act.

The intent of the question is to test the student's knowledge for packaging requirements for a type of photosensitive drug. Therefore, all of the distractors should be plausible responses from the packaging category, such as, clear plastic snap-cap vials, tightly closed clear glass vials, etc. Note that the areas suggested by the other distractors, dosage forms, practitioners authorized to dispense, etc., would also be suitable themes for a set of responses in separate test items.

The last distractor, although incorrect, may seem plausible to the student because of its length. Frequently, inexperienced test item writers will clue the student by using qualifying words in the correct response, thus making it longer and more plausible.

3. Identify the learning outcome or practice performance to be sampled. Then ask if that outcome or behavior includes some process which involves choosing from among some set of alternatives, whether they be facts, reasons, processes, applications, features of a drug product or other suitable variables.

4. Write the stem and correct response in a complete sentence form, splitting the statement at a point where most of the meaning is retained in the stem and only the response remains. For example:

   Disodium Phosphate is often added to an ophthalmic solution as a / buffer.

Plausible distractors such as preservative, mydriatic, miotic, etc. may be selected. Note that it may be necessary to re-write the complete sentence in order to place the response at the end of the sentence.

5. Write *plausible* distractors. A test item derived from the previous example might include other purposes of ingredients in eye drops.

Distractors may include: items which sound like the correct response, alternative but incorrect reasons for a condition stated in the stem, improperly calculated answers to the problem outlined in the stem, etc. The main point here is to ensure that the incorrect responses (distractors) are *plausible* and that they may serve to distinguish between the novice and the expert student. A distractor which is never selected only wastes the student's valuable test time and adds nothing to the reliability and discriminatory power of the test.

6. Arrange the responses in some standard fashion, either randomly, alphabetically, numerically or chronologically. An alphabetical example:

Which of the following drugs is listed in Schedule V of the Minnesota Controlled Substances Act?
- __A. Atropine
- __B. Caladryl
- __C. Demerol
- X D. Para-Pectolin

7. When using machine scoring requiring only one scored response, state this requirement in the test instructions. This need not obviate the occasional use of test items with more than one correct response. For example:

   Which of the following categories of drugs may be prescribed by podiatrists?

   __A. Analgesics
   __B. Digitalis Glycosides
   __C. Thyroid Products
   __D. Cortiocosteroids
   X E. A and D above

8. Avoid giving clues in the stem such as: key words in the stem repeated in a response, singular or plural subjects in the stem with corresponding responses or the words "an" or "a" at the end of the stem. For example:

   Which one of the following drugs manufactured by Roche is available in capsule form?

   __A. Libritabs
   X B. Dalmane
   __C. Azo Gantanol
   __D. Gantrisin

In this case, Libritabs is a response which will not distract students, thus leaving only three possible responses.

9. Where expert opinions may differ, cite the source in the stem of the question.
10. Use either four or five response items.
11. Avoid overlapping responses. These tend to reduce the number of responses available to the student and reduce the face validity of the test. For example:

    The most common dosage form strength available for Lithane is

    __A. less than 50 mg.
    __B. less than 100 mg.
    __C. more than 250 mg.
    __D. more than 500 mg.

    In this example, responses A and D are covered by responses B and C, thus leaving only two choices. The responses should be rewritten as:

    __A. less than 50 mg.
    __B. between 51 and 100 mg.
    __C. between 100 and 250 mg.
    __D. between 251 and 500 mg.

12. Avoid the use of negative statements in the stem or in the responses. This lengthens the amount of time the student must spend on the question and measures not knowledge of the content, but the student's ability to read and think generally. When negative questions are used in excess, error is introduced into the test and both reliability and validity of the test are lowered. If because of the context it is not possible to avoid a negative statement, the negative word should be underlined or capitalized. Double negatives should be vigorously avoided.
13. Re-check the test item for ambiguity, clues and plausible distractors. Remember that the multiple test item must discriminate between students who know and do not know the material. Any feature of an item which does not contribute to the discriminating function of the item should be rewritten. In review, a good multiple choice item should have the following features:
    a. The item will measure a learning outcome which can be measured through the selection of alternatives.
    b. The stem will present a single problem clearly, concisely and unambiguously, and it will contain as much of the item as possible.
    c. The correct alternative should be a better response to the stem than the distractors.
    d. The alternatives should be homogeneous and should follow logically and grammatically from the stem.
    e. The distractors should be plausible but incorrect (or not as good as the correct response) [TenBrink, 1974].

G. True/False Test Items:

The true/false item possesses many of the attributes of a multiple-choice item. It may be conceptualized as a two-response multiple-choice item in which the student reacts to only one response and decides whether the response is true or not. It has the advantage among objective tests of offering the format for fastest student response. Because of the relatively high speed with which students may progress through true/false test, the overall test reliability can be quite high in spite of properties of low reliability associated with each true/false test item. True/false tests are easy to score and they form a good pool of items for potential conversion to multiple-choice items. A principal disadvantage of the true/false test is its susceptibility to guessing.

H. Guidelines for Writing True/False Tests.

1. Select only the most essential content for testing. The premise, statement, concept or fact selected should be a clearly true and defensible statement which is obvious to the well-informed student.
2. Write the concept or statement in both true and false versions.
3. When higher-order concepts are included in the instruction, adapt the versions written above by including rationale, causes, effects, applications, etc.
4. Using notes developed above, write test items including other adaptations of the basic statements or concepts.
5. Avoid vague terms. For example:

   T F Phenmetrazine has high abuse potential.

   This item could be improved by including a point of reference.

   T F Phenmetrazine has a higher abuse potential than Donnagel-PG.
6. Avoid the use of qualifiers, such as "often," "occasionally," "never," "may," "generally," etc. If the elements of the true/false statement are not clear and unambiguous without the addition of qualifiers, the item should be abandoned or converted to another format.
7. The test should contain approximately the same number of true and false items, randomly placed in the test.
8. The true and false items should be approximately the same length to avoid giving the student cues that true answers may be longer or shorter.
9. Ensure that the items are completely true or completely false. Avoid use of broad generalities which are open to interpretation.
10. Tricky questions should be avoided. Nothing reduces student confidence in the instructor as rapidly as student impressions that variance in scores will be affected more by interpretation of tricky items then by true student performance. For example:

    T F Pharmacy license renewals are due on July 1.

In this case, the law requires renewals to be filed on or before June I and that licenses expire on June 30. Do the terms "are due on" refer to the renewal or expiration date? If the item refers to the expiration date, does July 1 mean June 30? The item should be rewritten as follows:

T F Applications for pharmacy license renewals must be filed on or before June 1 of each year.

A useful variation of the true/false item enables the student to supply the correct answer if the stated answer is believed to be false. For example:

T F Keflin is manufactured by ~~Abbott~~ Lilly.

This item could be scored:

plus 1 for true items marked true,
minus 1 for true items marked false,
plus 1 for false items marked false,
plus 2 for false items marked false and corrected.

I. Writing Matching Items:

The practice of pharmacy involves numerous classifications by drug categories, modes of action, sources, etc. The student's classification ability may be sampled in large numbers through the use of the matching exercise. The exercise consists of a set of Premises on the left hand side to which Responses on the right hand side are matched by the student. A properly matched pair is a test item. The following example is based on Sections IVC and IVD of this chapter. The reader is encouraged to complete the matching example.

For each term in Column A (premises), select the statement in Column B (responses) which best defines the term in Column A. Mark your answer on the appropriate line in Column A. There is only one correct definition for each term.

A.	B.
___1. Split-half reliability	a. An estimate of the degree of correlation between alternate forms of a test.
___2. Coefficient of stability	b. An estimate of the relationship between two measures of the same person.
___3. Coefficient of equivalence	c. A measure of the internal consistency of test results.
___4. Concurrent validity	d. An estimate of the correlation between the results of two different measures obtained at approximately the same time.
___5. Predictive validity	e. An estimate of the correlation between the results of some measure and the results of some criterion measure obtained at a later date.
	f. An estimate of how well a hypothetical construct is measured.
	g. An estimate of the correlation between the results of two administrations of the same test given at different times.

ANSWERS TO THE EXAMPLES: (read upside down)

1. c 2. g 3. a 4. d 5. e

K. Guidelines for Effective Matching Exercise Construction:

1. Decide on the categories to be involved in the classification and matching process. These categories may also include higher-order applications of knowledge such as pharmaceutical calculations and identification of clinically significant therapeutic incompatabilities.
2. Keep the content and style of both the premise and response columns homogeneous. Short responses of approximately even length are preferred. Following this guideline, the example above could be rewritten to place the easier-to-read terms in the right hand column.
3. Develop pairs of correct responses. Responses should seem plausible with more than one premise.
4. Develop additional responses to reduce the effect of selecting some responses by a process of elimination. The number of responses may approach 150% of the number of premises.
5. Limit the number of premises to six to ten. Additional matches introduce fatigue and error into the matching process.

6. Scramble the premises so student responses do not appear in a systematic order. Then arrange the responses alphabetically, numerically, chronologically, or in some other systematic fashion to save student time and reduce error.
7. Write instructions which specify clearly the student's task. Remind the student that only one response is possible for each premise.
8. Review the matching exercise for ambiguity and possible duplicate responses.

L. Use of Short Answer Items:

The multiple-choice item is generally preferred to the short answer item for reasons of both test and scorer reliability. However, for measurement of certain critical performances in the practice of pharmacy, the multiple-choice format does not suffice, because the cueing provided in the responses is not part of the context of the real world practice situation. For example, pharmacists are required to make many repetitive decisions and selections in the process of dispensing prescriptions. Because no errors are tolerated in the process, check systems are essential.Simulations of these check systems are not valid when they contain cues. A pharmacist performing a final check on a prescription dispensed by an intern scans the order, the label and the manufacturer's label for errors of commission or omission. There are no multiple-choice cues in real life that serve as a check list to determine if an error was made. Consequently, short answer responses, not multiple-choice responses are most appropriate for exercises in which students are asked to identify possible errors in prescriptions or prescription labels.

M. Guidelines for Short Answer Item Construction:

1. Allow sufficient space for the student's response. A student who can furnish a complete answer should not be influenced by a cramped response space or blank. It is a good idea to keep all response blanks or spaces of uniform length in order to prevent cueing.
2. Use a question format rather than requiring the student to complete a statement. Completing a statement requires the student to be influenced by the grammatical style in the statement. Open-ended questions permit the student to arrange the short response in any manner. If incomplete sentence formats are used, always place the blank at the end of the sentence.

VII. IMPROVING THE QUALITY OF CLASSROOM TESTS

In order to most effectively use the examination process to diagnose students' strengths and weaknesses, improve instruction and make individual pass-fail decisions, the test should be analyzed to determine its reliability and validity. Fortunately, the contribution of each test item to the overall test reliability and validity is also measurable through the use of the statistical package described in the appendix of this chapter. The package computes difficulty levels, discrimination indexes, point biserial coefficients and reliability estimates (KR21). A brief discussion of some of the statistical properties of test item quality will enable the computerized item analysis data to be used in the construction of a useful bank of items for future administration. There are two measures of item quality: the Discrimination Index and Item Difficulty Level.

A. Discrimination Indexes:

An item is said to perform well (test what it is supposed to test) when it discriminates well. A good test discriminates between students who are able to perform as described by the test's objectives and those who are not. Discrimination Index is defined as "A relationship between the item performance of a high group of students and a low group of students." Specifically,

	The proportion of the high group of students getting an item correct
minus	the proportion of a low group of students getting an item correct
equals	A discrimination index for that test item.

or $$D = \frac{R_u - R_l}{.5\,T}$$

where
R_u = number of students in the top 27% of the class.
R_l = number of students in the bottom 27% of the class.
T = total number of students in both groups.

The discrimination index is positive if a greater proportion of the high group gets the item right, is zero when both groups perform at the same level, and negative when the low group out-performs the high group on an item. Extremely easy or extremely difficult items in which every one gets the item either right or wrong display a zero index. As a rule-of-thumb, indexes of .4 or better are very acceptable, and items with indexes equal to or less than .2 are usually rewritten or discarded. Negative discrimination indices are a cue that ambiguity may exist in the item or that the item may have been mis-keyed. Negative items also seriously affect the overall test reliability and should be discarded or rewritten.

B. The Item Difficulty Level:

The item difficulty level is simply the proportion of students getting the item correct.

$$D = \frac{R}{T}$$

where R = number of students answering item correctly.

T = total numberof students attempting the item.

The sum of all item difficulty levels across all items equals the test mean. As a rule-of-thumb, a test will produce greatest variance when the difficulty level is approximately half the distance between the guess level and a perfect score. Thus the ideal values differ for the types of items administered.

Lord (1952) has suggested the following guide.

ITEM FORMAT	IDEAL AVERAGE DIFFICULTY FOR A MAXIMALLY DISCRIMINATING NORM-REFERENCED TEST
Short answer	50
Five-response multiple choice	70
Four-response multiple choice	74
Three-response multiple choice	77
True-false (two response multiple choice)	85

Note that the difficulty level does affect the discriminating power of the test. Items that are either very easy or very difficult show discriminating power of little value in testing difference between students. The difficulty level also directly affects the reliability of the test as measured by formulas ____F.6, ____F.7 and ____F.8 which depend upon test variance to assure high reliability.

C. What Is the Best Discrimination Index and Difficulty Level for Criterion-Referenced Tests?

If tests are prepared in the norm-referenced sense, the higher the discriminating power the better. Norm-referenced testing is enhanced by difficulty levels using maximum test variance. But what is tests are prepared in the criterion-referenced sense? Ideally, an instructor would want all students to reach criterion of nearly 100%, in which case the variance would approach zero and reliability would be very low. Livingston's formula (_____.10) corrects for this loss of variance but does not satisfy the question of whether the test, although shown to be reliable, measured what it was supposed to measure. In these cases where classic reliability theory fails because of low test variances, the instructor's attention should be given to achieving a low standard error of measurement and to the most basic quality of a test—content validity. If most students miss 20 of 20 test items on a section of a dispensing test dealing with dosage ranges, the instructor will not be impressed with a suggestion that the items failed to discriminate, were not reliable and should therefore be discarded. Instead, the content validity of those items would be reviewed and remedial instruction furnished to enable the students to master the area of dosage ranges.

VIII. MISCELLANEOUS TESTING CONSIDERATIONS

The instructor should do everything possible to reduce test error. The following guidelines serve to reduce error in test-taking, thus enhancing the student's opportunity to achieve a true score. Prepare the students for tests in advance. Tell the students the test format to be used as well as the content areas to be covered. Tell them your grading policy and the weight of each test in the overall grade.

A. Guidelines for Assembling the Test:

1. Group items from the same format together and arrange the formats from the simplest to the most complex.
2. Place several of the easiest items from the first format at the beginning of the test. This tends to reduce student anxiety and build student confidence.
3. If the test consists of several sub-tests on major content areas, these should be clustered together for ease of sub-test grading. Sub-test scores are often useful diagnostically.
4. Arrange the test items so that the correct answers appear in a random pattern.
5. Include a section of general instructions, plus specific instructions for the use of each item format. The general instructions should include such things as: test length, number of total points, weights given to each section, instructions for the use of the answer sheet (if used) and directions for placement of student identification or other demographic data.
6. Avoid splitting of matching or multiple-choice items between two pages.
7. Present the assembled test to a colleague for checking.

B. Guidelines for Administering the Test:

1. Arrange for uniform seating, such as every other seat in every other row. Students may be seated according to a special seating chart in order to break up pairs of students who may be prone to consult each other.
2. Read the general instructions to the students and make any necessary announcement correcting possible typographical errors in the test. Explain the student identification, use of the answer sheet and ending time of the test.
3. Observe carefully for signs of cheating. If cheating is suspected, observe and record the suspicious behavior. Obtain the converging observation of another test proctor. Do not accuse the student of cheating during the test. If test security is to be maintained, pass out the tests one at a time after students are seated. Do not permit students to wander to the front of the room to obtain their tests.

C. Guidelines for Scoring the Test:

1. If machine scoring is contemplated, make arrangements to use the Datronics answer sheets and scoring machine which are located in Room 107 of the Fenwick Building, 318 Harvard St. SE.
2. If hand scoring on the main test is contemplated, design the test in a manner permitting easy-to-score responses located in columns along either the right or left side of the test.
3. Prepare a key in advance and verify it.

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Appendix

Instructions for Preparing Item Analysis Data

WRITE-UP FOR ITEM66 MARCH 1976

I. Problem Description Card

Column	*Punch*
1-6	ITEM66
7-10	Number of items in the test (not larger than 300).
11	Option to be used in the calculation of item discrimination: 1 for upper 50% versus lower 50% (2 groups), 2 for upper 33% versus lower 33% (3 groups), 3 for upper 27% versus lower 27% (3 groups), 4 for upper 25% versus lower 25% (4 groups), 5 for upper 20% versus lower 20% (5 groups).
12	———
-	Number of response alternatives per item, if constant across all items. If the number of response alternatives varies from item to item, punch 0; the number of response alternatives for each item will then be supplied by the RESponse cards) (see below).
14	(Optional) Punch 1 for a by-pass of all item response distributions. Otherwise, complete item information will be given.
15	———
-	Number of data cards per subject (not larger than 5).
17	(Optional) Punch 1 if the identification numbers on each set of data cards are to be checked for consistency. If this option is used, the number of items on each data card must be given in columns 27-36
18	(Optional) Punch 1 if each subject's identification number and total score is used, the program will read the first data record (in the format supplied) as a KEY.
19	(Optional) Punch 1 if no KEY card is present; if this option is used, the program will read the first data record (in the format supplied) as a KEY.
20	(Optional) Punch 1 if previously input data file is to be rewound and reread. This option allows more than one scale to be analyzed in a single run.
21-26	———
27-36	(necessary only if a 1 is punched in column 17) Punch the number of items on each data card; format is 512.
37-40	———
41-80	Alphameric job identification; this information will be reprilted on the output.

II. Format Card(s)

This program requires a subject identification number be read first in an I field: item responses follow, also read in I fields. (If there is a 1 punched in column 17 of the Problem Description card, then a separate format card is required for each data card in a set; each of these format cards must have an initial I field for reading in the subject's identification number).

III. KEY Card(s)

Columns 1-3 of the first KEY card are punched KEY. Columns 4 to n-3 should contain the correct numerical responses for the n items in the test, in the order in which they appear on each data set. If more than 77 items are on the test, more than one KEY card will be needed, so continue on other cards, beginning in column 1; thus, the correct response for item 78 would appear in column 1 of the second KEY card. The format for the KEY card(s) is then (A3, 7711/(8011). Note that no KEY cards are to be supplied if column 19 of the Problem Description card is punched with a 1.

IV. Response Card(s)

These cards are only required if column 13 of the Problem Description card is punched 0. Punch RES in columns 1-3 of the first RESponse card; then, in columns 4-80 punch the number of possible responses to each item, in the order in which the items appear in each data set. If more than one such card is needed, continue on a second card, beginning in column 1. The format for the RESponse cards is thus (A3,7711/(8011).

V. Data

The data are assumed to be integers (I fields). Each record (i.e., each set of cards representing an individual subject) must have an initial identification number. Data are assumed to reside on input unit TAPE 1. Zeroes, blanks or numbers larger than the number of possible item responses will be considered as bad/missing data, and will be programmatically set to zero.

VI. End of Data Card(s)

The program will read data cards until either (1) an end-of-file mark is encountered, or (2) a record (*complete* set of data cards) having a negative identification number is read. The second option may be used if it is desirable to analyze more than one group of subjects in a single computer run.

VII. Finish Card

After the last program card has appeared, a card with FINISH punched in columns 1-6 should follow.

IX. Limitations

ITEM66 allows analysis on tests no longer than 300 items each, with no more than 1000 subjects in a given group; these parameters may be increased under certain circumstances. See the statistical consultant if this is a constraint.

No item may have more than 9 (or less then 2) response alternatives.

Missing data (zeroes, blanks and numbers larger than the specified number of response alternatives) will be recoded to zero and excluded from the analysis. The output will inform you of such changes by printing the identification number, item number and the (bad data) response for all subjects for whom such changes are made.

X. Order of Cards

(System control cards; see next page for sample listing) 7/8/9 (7,8 and 9 all punched in column 1)
Problem Description Card (Required)
Format Card(s) (Required)
KEY Card(s) (Optional)
RESponse Card(s) (Optional)

.
.
.

(Repeat as desired)

.
.
.

Problem Description Card (Required)
Format Card(s) (Required)
KEY Card(s) (Optional)
RESponse Card(s) (Optional)
FINISH Card (Required)
6/7/8/9 (orange end-of-job card; required; supplied by Computer Center at the site at which the run is made)

EVALUATING EXPERIMENTAL COMPETENCY DETERMINED PROGRAMS

Richard L. Holloway
C. Anderson Johnson

Any effort directed toward redesigning curriculum or instruction must document its progress. Moreover, this process of documentation must serve to inform participants in a program so that decisions can be made about the program's direction. The evaluation of programs should serve these needs.

The following chapter is intended to give the reader some ideas for conducting programmatic evaluation so that needs for information can be met and decision-making may be facilitated.

There are many conceptual papers which can serve as a guide to evaluating a competency-determined pharmacy program. Stake (1967) provides an excellent guideline for programmatic evaluation as does Scriven (1967). Evaluating a competency-determined program is not very different from evaluating any experimental program. The measures used to monitor student achievement (i.e., criterion-referenced testing) may differ, to be sure, but the conceptualization of an evaluation plan will probably proceed similarly to the operations of any program evaluation. An evaluation design for any experimental program should produce worthwhile, usable results.

So why is there a need for this specific chapter? Why prepare an entire document entitled "Evaluating Experimental Competency-Determined Pharmacy Programs"? Perhaps there is a need to clarify the issues surrounding evaluation *in general* so that these ideas can be applied to Pharmacy Education and competency-determined pharmacy education in particular.

THE RELATIONSHIP BETWEEN EVALUATION AND RESEARCH

The process of educational evaluation differs from theoretical research, although program evaluation often contain research components. Educational evaluation uses a language often associated with theoretical research, yet it is rarely considered to be a theory-building process. Educational evaluation is, instead, the process whereby data for decision making is collected, progress in a project is documented, and comparisions are made between what was completed and what was supposed to be completed or between an existing program and a "new" program. To the degree that answers to these questions are generalizable to other similar programs, evaluation contributes to a body of knowledge about programmatic changes. However, the purposes of evaluation are more often specific to the particular program being evaluated in order to guide action for decisions.

The specificity of evaluation purposes add some dimensions to evaluation which are not found in theory-building research. For instance, there is a relatively high degree of emphasis on description in evaluation (Stake, 1967). Often, evaluation methodologies are far more elaborate than those used in theory-building research (Scriven, 1967) since evaluation must account for many complex variables which contribute to the overall effect of a program. The purpose of evaluation are not only to "sum" the effects of a program (summative evaluation) in order to make major decisions about its continuance, but to "form" the program *as it proceeds*, adapting it to faculty and student needs, (formative evaluation). Any evaluation would fail to serve its clients (faculty, students, administration), if it provided only summative information. The first section of this chapter will address the issues which surround summative evaluation questions. Summative evaluation tends to be more formal in its approach than does formative evaluation. Summative evaluation asks more basic questions about the relative worth of a program and therefore relies more heavily on research methods.

SUMMATIVE EVALUATION

The processes by which evaluation proceeds, like research, rely on some basic premises of inquiry. Questions must be operationalized so that outcomes can be measured meaningfully. And, like research, three major elements of inquiry must be considered: description, comparison, and prediction. The next three sections will review some principles by which these three concerns may be met.

I. *Description*

Perhaps the most important function an evaluation can perform in a direct way is to provide information descriptively to its constituents: faculty, students, and administration. There are many levels and kinds of descriptive information which might be useful. For instance, grade distributions across a test may be extremely valuable to the planning efforts of the faculty. In addition, the test information can be broken down into a number of profiles such as scores across individual classes, by year, within competencies, or within terminal performance objectives which support and lead to the competencies.

Besides descriptive information about groups of students, information can be compiled about the test itself (or any other instrument such as attitude surveys or personality profiles). The quality of these instruments should be reported as soon as the data are available. Testing instruments can be described qualitatively. There are statistics which will give an idea whether items are too difficult, too easy, or whether they discriminate between "good" and "bad" students. We can also report how reliable a test is--that is, does it measure the same things consistently. Sometimes we take test quality for granted--"if it looks good, it must be good" --but these descriptive analyses will help us to determine *empirically* how tests really perform.

So, what is suggested above is two kinds of descriptive information: test quality, and the results those tests provide.

A. *Test Quality*

As briefly mentioned above, there are several dimensions of test quality. These are reviewed in detail elsewhere in the Handbook (see Grussing, P. FI-F24). But to provide an overview, here are some of the dimensions of test quality that are generally reported in relation to the instruments used in an evaluation:

1) Difficulty: Items on a test often vary in difficulty. These subtle differences may not appear when writing items for uniformity; however, when a group of students has responded to a set of items, item difficulty indices can be computed. These are usually reported in terms of percentages of correct respondents. For instance, an item difficulty index of .96 means that almost all students got the item right. Item difficulty will be an important consideration in a large comprehensive test where it is expected that certain items will be more difficult for first year students than they are for students in the later years. This suggests that item difficulty will be more meaningful when it is reported in terms of specific student groups.
2) Discrimination: One of the most important properties of test items is their ability to differentiate between students who perform well overall and those who do not perform as well. Discrimination is a numerical index of an item's relationship to the highest and lowest scoring students on the overall test. In a competency-determined program, usually higher discrimination items are more valuable since they more clearly separate those who are competent from those who are not.
3) Reliability: There are many facets to reliability, but in general we will refer to this term as the consistency with which a test measures something. One of the most often used coefficients computes the *internal* consistency of tests, meaning the uniformity of items within the test given a single administration. These measures of internal consistency are either the Kuder-Richardson formulae, so-called "split-half" estimates, or a specialized form called Cronbach's Alpha. Each of these has utility in describing a test's internal consistency.
4) Validity: Even if an instrument measures something consistently, it may be consistently wrong. Validity is the property of "truth" in a test: Does the test really measure what we think it does? Testing instruments must be carefully constructed to insure that they are actually calling for the information the tester wants from students. This applies to attitude surveys as well. One must be sure that the questions accurately assess the attitudes about which information

is desired. However, one of the problems with assessing instrument validity is that it is extremely difficult to quantify. Most studies of validity require detailed investigations either as research studies or the determination of content by the *consensus* of a group of experts in the content area. So, the process of arriving at the content within competency areas by a panel of expert judges is one kind of validation. Although it is impossible to quantify such activities, it is crucial to rely on this kind of expert judgement for *content* validity. Other kinds of validation serve to determine a test's ability to predict performance, or its relationship to a theoretical construct such as a personality variable.

B. *Test Results*

Test results should be reported in as clear and concise a fashion possible. This helps make results more meaningful for potential faculty uses. Graphs and histograms are always helpful when reporting data to a faculty. These might be displayed to show comparisons between groups, classes, or schools. A number of descriptive statistics: means, standard deviations, ranges, and percentages can be used to facilitate comparisons.

II. *Comparison*

The essence of evaluation is comparison, and the problem of evaluation is selecting the proper comparisions. Two kinds of comparisons have been used in educational research: before-after comparisons in which the product of an innovative educational program is compared with the product of the same institution prior to initiation of the program; and *between-groups* comparisons in which two programs are compared simultaneously. The terminology "before-after" and "between-groups" implies experiemntal or experimental-like methodology. Analogous terminology from survey and archival research would be "time-series" and "cross-sectional" comparisons, respectively.

Before-after comparisons can take either of two forms. For the repeated-measures design, individuals are assessed on the outcome objectives of the innovative program prior to beginning the program. This "before" measure serves as a benchmark (baseline) against which the after measure is compared. The value of the program is then assessed in terms of the degree of change produced over a period of time. The primary limitation of the before-after measure is that it in no way protects against the possibility that outcomes may have been produced by factors extraneous to the educational program; for example, maturation of the student and experiences which are not part of the program but which are commonly shared by all participants (what Campbell and Stanley, 1963, refer to as maturation and history effects, respectively). A second limitation of the before-after design is that it does not permit evaluation of the program relative to others. Even if one were certain that the change in students' level of knowledge, motivation, skills or whatever was the product of the new program, one is not able to say whether these objectives were obtained as effectively as would be the case with reasonable alternative programs. This potential restriction becomes severe when one considers abandoning an old program for a new one. The proper question then is, "Is the new better than the old?".

A second before-after design has often been mistakenly understood by educators to answer the "new better than old" question. In this design, the participants measured before implementation of a program are different from those measured after. The final product (matriculated students, for example) of an old program is compared with the final product of the new. Again, historical events apart from the program compete as an alternative explanation for any results observed. Just as serious a threat to validity is the possibility that students entering school in one era are quite different from those entering in another era. The problem is really unsurmountable within this design, because random assignment or even assignment by stratification (a far less desirable procedure, as we shall see later) are not possible. In short, the before-after design so often used in educational research has severely crippling limitations in either of its common forms. It is really hardly more useful than "evaluations" without a benchmark for comparison, i.e., the no control group-after only-design (see figure 1).

Figure 1. Inadequate Evaluation Designs

1. No control group – after only-design	X O
2. No control group – before-after repeated measures design	O_1 X O_2
3. Control group before – treatment group after design	P – O_1 – – – $\overline{X}$ $\overline{O}_2$

Where: X = treatment (experimental program)
O = observation/measure
P = previous program

A second and more useful evaluation approach is to compare the out-come of a program with the outcome of a similar but different program occurring at the same time and directed at the same kind of participants. If participants are the same, then maturation (physical growth, aging, etc.) will occur concurrently at a similar rate for the two groups. The only sure way to achieve freedom from history effects is to assure experimental isolation, in social research carried over time, which is an impossibility. An alternative is to assure that meaningful historical events occurring to one group also occur to the other. Reasonable assurance of this objective can be had if the two groups exist at the same or nearly the same place at the same time.

A true experimental approach which would provide the maximal protection against maturation, history and individual difference effects would be one in which participants are randomly assigned to two groups, the control group and the treatment (innovative program) group. Participants of each group then receive the curriculum and only the curriculum of their own group but at the same time and place as the other group. Despite its desirable aspects, this true experimental approach is often not acceptable, for several reasons. First, two curricula would have to be established to be run concurrently and administered by the same faculty (to minimize differential instructor effects). That would double the number of teaching sessions required of each faculty member. Second, the financial costs of maintaining parallel curricula would be difficult. And third, isolation of one treatment group from the other, to prevent contamination through personal interaction, while potentially achievable, might produce a degree of discord among students as well as among faculty and would be disruptive to the purposes of the College. For these reasons, and there undoubtedly are others, a true experimental design (random assignment of students to simultaneously occurring programs within the College) is unacceptable.

A second compromise design captures the essence of the experimental method while making certain concessions to expediency. This design employs an external control group* *outside* the College of Pharmacy. In that design, other colleges of pharmacy with curricula, students and faculty thought to be similar to those at the program under study are used as benchmarks for comparison. This design would combine before-after measures with between-group measures in such a way that a change in product can be demonstrated in the program after initiation of the new curriculum, and (a point that is crucial) no change can be demonstrated among the external

*It is difficult to envision a true "control" curriculum, since a similar professional curriculum would probably be aware of the experimental curriculum's progress. A more appropriate term might be a "comparison" curriculum which functions in the role of a control group in experimental design. Any "control" curriculum would probably be aware of the experimental activities carried out at another college, so true control over variance would be virtually impossible.

control groups occurring simultaneously at schools in which no similar curriculum changes have been initiated. Figure 2 may be helpful in pointing out similarities and dissimilarities of this modified experimental design and its truly experimental but unacceptable counterpart.

Figure 2. Differences between true and modified experimental designs.

Before-After Experimental Design	R	O_1	X	O_2
	R	O_1		O_2
Modified Experimental Before-After Design	S	O_1	X	O_2
	S	O_1		O_2

R = Random Sample
S = Stratified Sample

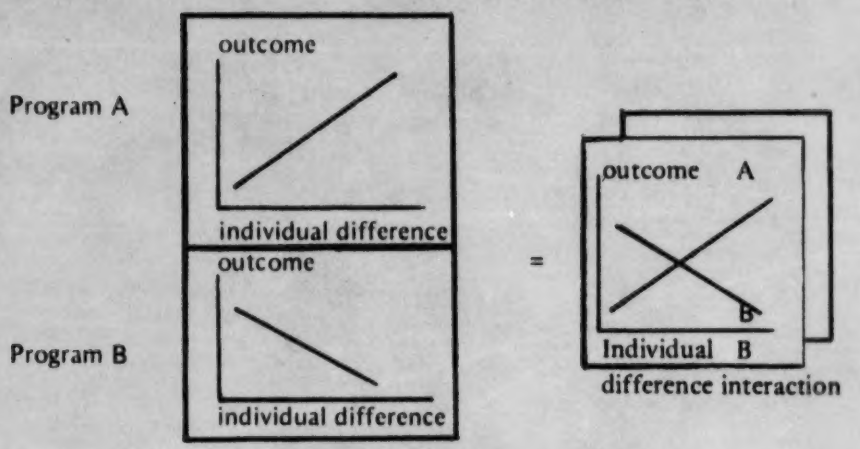
First, random assignment of participants to treatment groups will often not be possible. Random assignment (R in the figure) is fundamental to true experimentation because it guarantees, according to the law of probabilities, equal distribution of all individual differences into the various treatment groups. Less desirable, because one can never be sure of what the "important" individual differences are, is the stratification (S in the figure) approach in which individual differences presumed to be relevant (e.g., age, I.Q., socio demographic data, need for achievement), are equated by assignment to the treatment groups. Despite its limitations, stratification can be and often is done where randomization is impossible. Unfortunately, it is sometimes substituted unnecessarily for randomization out of the mistaken belief that stratification is a better procedure. The stratification procedure that we propose would be to select colleges of pharmacy *similar* to one's own college in several areas: faculty-training, age and productivity; curricula – graduate as well as undergraduate; and student age – prior training and aptitude (PCAT scores).

Since any program reflects not only differences in "treatments" but potential differences among student attitudes, motivations, and general ability, it may become important to assess individual differences between groups of students even though care has been taken to assure equivalence (as nearly as possible) between groups. The following section on predictions will illustrate how individual differences and treatments may be used in conjunction with one another to better evaluate a program.

III. *Prediction*

Having selected a comparison program, one may operate using any number of experimental procedures. One family of designs that is especially useful is the regression approaches. Regression appraoches can successfully account for variance contributed by any of the individual difference measures which have been selected, such as achievement motivation or need for affiliation. Used in the external-program control group design, comparisons can be made between relationships (individual differences to outcomes) at one program with relationships at another. The general form of this kind of design is shown in figure 3.

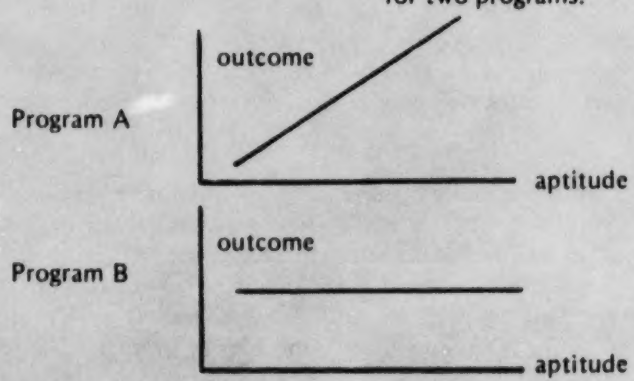
Figure 3. Regression – interaction approach to evaluation design.



In figure 3, regression lines are obtained for the relationships between an individual difference measure (comprehensive test scores, for instance) for each of program A and B. These regression lines are compared between programs to form an individual difference x treatment interaction. This kind of interaction analysis may be useful in describing the characteristics of one program which differ from characteristics of another.

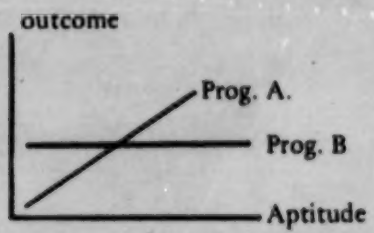
For example, let us consider the case of a program which has systematically altered its curriculum. This curricular alteration may produce some pattern of relationships between an aptitude and outcomes on a comprehensive test. At the same time, the outcome measure and the individual difference (aptitude) measure is administered to another program. Let's suppose that there was a different relationship – a flat regression line signifying no relationship between aptitude and outcome. So, in Program A we have a positive relationship and in Program B we have no relationship between aptitude and outcome (figure 4).

Figure 4. Aptitude-outcome relationships for two programs.



When these two regression lines are combined on one scale, an interaction appears to be present (figure 5).

Figure 5. An aptitude x program interaction



An interaction is said to be present when the regression relationship from one program differs from the regression relationship from another. There are statistical procedures for determining these differences which are beyond the scope of this paper.

The important question for an evaluator now becomes "what do these relationships tell me about the new program?" The differences in relationships can be crucial in describing, comparing and predicting differences in programs.

Regression methodologies are especially useful as predictive tools. If we can establish the relationship between an individual difference measure and outcomes for a program, we can then predict success in that program for students as they enter. For instance, if an individual difference measure like need for achievement is related to outcomes only for high ability students and is unrelated to outcomes for low ability students, we may wish to prescribe a certain kind of treatment for those high ability students. Conversely, (in this example) it may not make any difference which treatment low ability students received. This becomes even more useful when a variety of instructional strategies are employed in a curriculum. If some students are shown to have performed more successfully than others in an alternative instructional strategy based on individual difference measures, then we may be able to suggest instructional alternatives for students before they enter a course. This can be possible only after many individual differences have been assessed.

The preceding section has dealt with the methods for answering summative evaluation questions. The following section will briefly outline some of the concerns of formative evaluation, the process by which participants in a program are given information and can modify the program *enroute*.

FORMATIVE EVALUATION

Evaluation and research tend to use the same kind of language, have similar problems of design, and address similar kinds of questions. But they are different – different enough to warrant the emergence of evaluation as its own discipline. There are political, emotional, and social issues which surround evaluation-issues which are not usually a part of a research design. However, these issues have an enormous effect on the program being evaluated – so, they must be considered.

One of the most important functions an evaluation can serve is to provide information on a regular basis to participants in a program. This information process may be carried out in a variety of ways, but serves to help form a program's complexion.

Often, the process of providing information will happen very informally – many requests for information happen on a "walk-in" basis. Put in a more systematic sense, formative evaluation will be associated with specific projects which faculty participants may undertake. For instance a faculty member who has contacted the evaluator about a specific experimental course design may wish to get feedback about the course unit-by-unit. To accomplish this, the evaluator must gather information regularly and report it quickly to make use of the data in revisions of the course.

These data will come from a variety of sources. Unlike summative data, the reportage of results will probably be on an informal basis with individual participants. Using this method of interaction, data can

be incorporated into formative decisions. Operationally, this may be accomplished by combining evaluation consultation with consultation conducted by an instructional development expert. In this way, the formative process can be more easily facilitated.

SUMMARY

Typically, participants in an experimental program will ask "how do we know this program is any better than what we were doing before?" To begin to answer this question demands that we take into account the larger context in which program exists. We cannot be content with results which will isolate a curriculum as a "treatment" when the politics, emotions, and social needs are as much a part of the curriculum as the more intentionally manipulated parts of it. Furthermore, a curriculum is *people* — faculty members, students, and investigators who will all have their effect. So to answer the question "how do we know this curriculum is any better?" is a multi-faceted inquiry. The processes of formative and summative evaluation propose a multi-dimensional approach to these multi-dimensional questions.

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RATIONALE FOR DEVELOPMENT OF MULTIDIMENSIONAL ASSESSMENT PROCEDURES OF PHARMACY STUDENT COMPETENCE THROUGH THE ASSESSMENT CENTER APPROACH

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Paul G. Grussing, M.S.

INTRODUCTION

During five years of pre-professional and professional education, the pharmacy student proceeds through a hierarchy of learning experiences. Discrete units of instruction are logically sequenced to permit the integration of previous learning into increasingly complex levels of cognition and skill development. The student's progress is measured during and after each unit of learning, usually through the use of paper and pencil tests. Although higher order levels of learning involving the use of problem solving and professional judgment occur increasingly as the student participates in the terminal portions of the educational process, comprehensive assessment of the student's overall competencies seldom exists within the curriculum. In the absence of a terminal assessment, certification of successful completion of professional education is based on a summation of measured cognitive achievements throughout the steps of the educational process. Moreover, the licensing examination in its present format is duplicative of college-based measurement in that it consists largely of paper and pencil tests for knowledge in five didactic subjects, together with a paper and pencil "practical" exam serving as a proxy measure for direct observation of practice performance.[1]

This paper discusses the advantages and disadvantages of alternative forms of measurement and describes an approach for assessing overall competence of the pharmacy student, based on a multiple-measurement method involving student performance in real practice contexts or in standardized simulations of practice. The combination of proposed measures should provide information about how pharmacists solve problems and react in complex pharmacy practice situations, rather than measure merely how much knowledge the pharmacist has stored for retrieval.

Competencies have been identified and validated using several converging techniques: competency identification using a panel-of-experts approach based on goal analysis[2]; evaluation of tentative competencies by 655 practitioners, faculty and students; and validation of the competencies using a job analysis technique involving 14 community and institutional pharmacies[3,4,5]. In addition, content analyses of each competency have been completed, showing for each competency a hierarchy of objectives to be used for instructional design and student assessment purposes[6,7].

In their dialogue with pharmacy faculty, curriculum developers use terms which have different shades of meaning between disciplines, and indeed among educational specialists themselves. Accordingly, the terms "measurement," "evaluation," "student assessment," "competency" and "assessment center" will be defined before proceeding.

> "Measurement" is synonymous with testing as it is commonly understood and used. "...A systematic procedure for observing a person's behavior and describing it usually with the aid of a numerical scale or a category-system."[8]
>
> "Evaluation" means the systematic collection of useful information, including measurement data, followed by the analysis of that information in a decision-making process to determine the worth or value of a product or process.[9]
>
> "Student assessment," as it is used in the project, is synonymous with student evaluation, and refers to the collection and use of data for comparing and reporting student performance and for curriculum improvement.

"Competency," as it is used in this project, means an intellectual, attitudinal and motor capability derived from a specified role and setting, and stated in terms of performance as a broad class of behavior. The term is *not* synonymous with "performance objective." A competency can be analyzed and subdivided into sequential terminal performance objectives. A competency may be assessed in a holistic sense in an environment which simulates the real world practice setting in which performance is expected to take place and from which the competency is derived.[10]

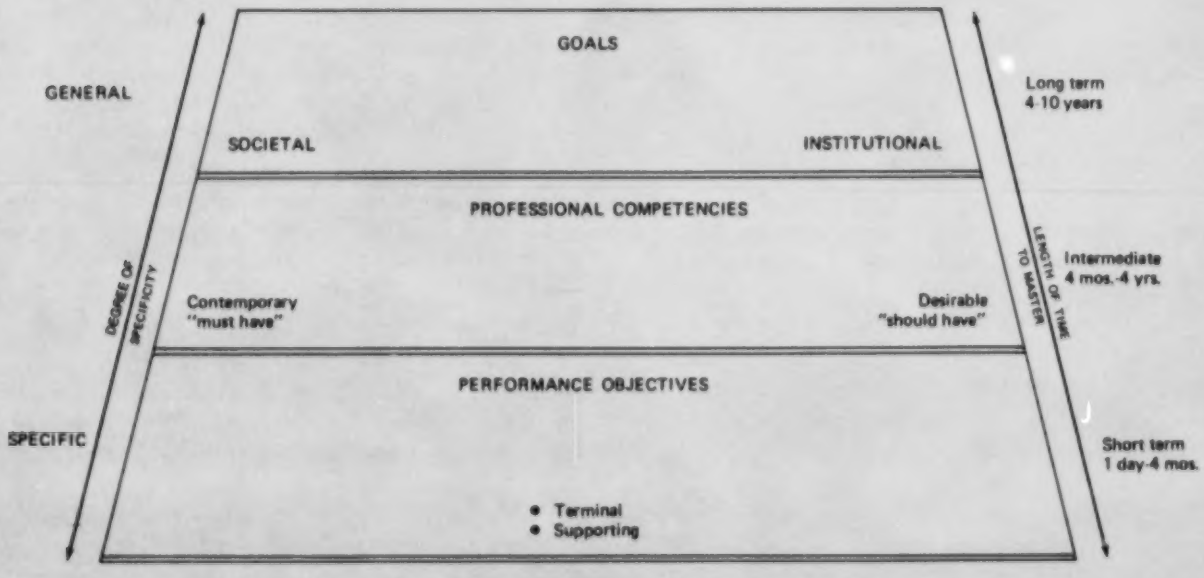
"Assessment center" means a standardized evaluation of behavior based on multiple inputs. Multiple techniques and trained observers are used. Judgments about behavior are made in part from specially developed assessment simulations. These judgments are pooled by the assessors at an evaluation meeting during which all relevant assessment data are reported and discussed, and the assessors agree on the evaluation.[11]

TOWARD A DEFINITION OF COMPETENCY IN PHARMACY PRACTICE

A review of the literature has revealed that there are divergent meanings of the term competency.[12,13,14,15] Most programs in pharmacy education and other health science areas have equated a competency with a behavioral objective according to Mager,[16] although Mager himself has gone beyond this early approach, and Popham[17] has rejected it. If it were true that behavioral objectives are competencies, then we simply would have old wine in new wine skins.

As the concept of a competency-based curriculum was explored, the need for a theoretical definition of competency was found to be requisite to further work.[18,19] Figure 1 depicts the concept of pharmacy competencies which is defined in the introduction.

FIGURE 1—RELATIONSHIP OF PHARMACY COMPETENCIES TO PERFORMANCE OBJECTIVES AND PRACTICE.



Competency is viewed as a composite of many performance objectives. It is not single performance specific since performance of discrete tasks can be mastered independently of each other and can be applied effectively or ineffectively in different situations. Nor is it necessarily subject area or course specific, since complex practice situations demand the integration of knowledge and skills from numerous areas. It is this situation referent which will determine which specific performances are most appropriate and critical for assessment purposes. Competence, then, will be determined by situational outcomes and the impact of critical practice-related performance.

A student's level of competence can be described as the correctness of these outcomes along a continuum of completeness between what was done as compared to what should have been done. Although classroom tests will still be necessary, the assessment emphasis will shift away from isolated incremental behavioral objectives which usually address memory and low-level comprehension skills. The emphasis will be placed on clusters of higher-level performances which call for professional judgment and problem solving. This comprehensive approach[21] to a competency definition differs significantly from many other competency-based programs since the shift of emphasis is from the act of teaching to the results of learning. Traditional student assessment procedures requiring simple storage and retrieval of information (paper/pencil) could not be utilized alone, given this approach to competency definition. Assessment is an integral part of this synergistic project and must be conducted in an environment that approximates the real world setting and role in which the performance is expected to take place, and from which the competency is derived. The emphasis on *performance* in a practice measurement is consistent with competency in pharmacy as defined by the task force on Continuing Competence in Pharmacy of the American Association of Colleges of Pharmacy and the American Pharmaceutical Association[21].

The theoretical definition of competency has been useful to distinguish this approach from well-established concepts which were already familiar to faculty members. The use of behavioral objectives, mastery learning and individualized instruction was evident before the Curriculum Improvement Project began. A similar need to conceptualize and define competency-based education for the public school community was recently expressed by Dr. William G. Spady of the National Institute of Education when he defined competency-based education as,

> "...A data-based, adaptive, *performance-oriented* set of integrated processes that facilitate, measure, record and certify within the context of flexible time parameters the demonstration of known, explicitly stated, and agreed upon *learning outcomes that reflect successful functioning in life roles*." (Emphasis added.)[22]

THE PURPOSES OF AND REQUIREMENTS FOR EFFECTIVE MEASUREMENT

In the context of the Curriculum Improvement Project, student assessment procedures have several purposes:

a. Determination of the student's performance capability in relation to established standards of performance.
b. Comparison of student performance to some performance standards internal and external to the college.
c. Provision of feedback during the instructional process so that both the student and instructor will know how the student is progressing relative to the performance objectives.
d. Improvement of the existing instructional process.
e. Design of new instruction.
f. Student grading and reporting.

The overall purposes of student assessment will determine the procedures used in collecting data and the nature of subsequent decision-making. If the assessment data will be used to make pass/recycle judgments about individual students, the quality of the assessment procedures should be of central concern. Quality means the degree of validity and reliability of the assessment procedures used. Validity refers to the truth of the measurement, indicating whether it is measuring what it is intended to measure as reflected in the performance objective.[1] Validity of the procedures typically improves as they more closely approximate the conditions found in the real world. If real world conditions cannot be replicated for performance assessment, then these conditions must be simulated in some manner. Reliability describes the consistency with which the

assessment procedures produce the same results over time. Reliability will be affected by the:

a. Consistency in the assessment situation from one student and observer to another. Extraneous sources of error must be eliminated.
b. Specificity and appropriateness of the performance.
c. Extent of "real world" performance being sampled. Longer measures produce more reliable results.
d. Objectivity of the scoring. The standards used by observers must be valid and uniformly applied among students to insure reliable results.

A REVIEW OF MEASUREMENT METHODS

Initially, broad classes of student assessment techniques were reviewed for the kinds of data that they might provide alone and in combination with other measures. Specific assessment procedures were then reviewed to determine if they could provide both proximate and ultimate data relative to the assessment of professional competence. These classes of assessment procedures included:

a. Objective examinations.
b. Essay examinations.
c. Project assignments.
d. Attitudinal measures—written and observational.
e. Simulation or situational assessment.
f. Oral examinations.
g. Observational reports.

a. *Objective examinations*. The purpose of this type of assessment procedure is to limit the subjective judgment of the instructor. Included within this category are constructed response varieties such as one-or two-word "fill-in" and short one- or two-sentence answers; selected response as found in multiple choice, true-false, matching, or rank order items. Objective examinations can measure a wide spectrum of cognitive performance objectives, but have generally been used to measure knowledge or comprehension levels. This method is efficient when large groups of students have to be assessed on a broad spectrum of knowledge in a relatively short period of time. These tests take time to develop, but the scoring is easily accomplished either by hand, machine or computer, and final results can be fed back to students soon after the test has been completed. The objectivity of the scoring allows the use of a variety of statistical procedures and item analyses. Guessing can affect the final score if the number of alternative answer choices is limited, as in the true-false variety. Unless carefully constructed, distractors may cue the student to the correct answer. The range of correct response choices must be delimited in constructed response varieties. Standardized norm-referenced tests of this type which have been validated and provide reliable results are excellent measures to provide relative rankings among groups of students. Objective examinations measure knowledge comprehension, application of knowledge and can identify certain types of attitudes. Properly written, they may measure higher levels of learning but are not commonly used to measure performance.

b. *Essay examinations*. These free-response examinations allow the student to respond at length in writing to a wide variety of problems or situations. This measurement technique is best used when the objectives can be validly assessed through written response. It allows the instructor to judge analytical or problem solving abilities, overall attitude (if appropriate) as well as written communication skill. Because of the time required to score, this instrument is best used with smaller groups of students. Segments abstracted from past student responses can be used as distractors for subsequent development of selected response assessment instruments. It is probably one of the least time-consuming instruments to develop.

The major weaknesses of this type of exam are the subjectivity of scoring and the time required for scoring. Students with poor verbal expression skills will probably not do as well as those students who write well. Essay exams may be used to measure knowledge and attitude, but are not used to measure performance.

c. *Attitudinal measures*. These can consist of paper and pencil procedures, observation of student behavior by instructors and peers, and ratings of student behavior in a variety of settings. Changes in attitudes can be measured by instruments such as the semantic differentials, Likert scales, projective techniques or the Thurstone method.

Behavior rating scales are designed to assist the instructor to observe and describe student performance in either a real world or simulated environment. Working with a predetermined list of behavioral descriptors jointly determined to be indicative of a given attitude, the instructor observes the frequency of the behavioral manifestations over a period of time and provides a summative rating of the student performance. Behavior rating scales provide a more valid picture of actual student performance relative to expected professional attitude than do other tests. However, they are more costly and time-consuming to develop, administer and score.

d. *Simulation or situational assessment*. These consist of proxies of real world performance in a controlled environment. The behaviors of the student in dealing with standardized situations are more important than the products of those behaviors. The simulations may consist of paper and pencil exercises or actual performance through interaction with other students, models, instructors, preceptors or a computer. Simulation games may consist of problem solving exercises reflective of actual work-related problems and situations. Simulations combine problem solving, judgmental, decision making, interpersonal and communication skills in an actual performance format. Observations of behavior, either through the use of behavior rating scales or the use of multiple assessors, can provide valuable data about student attitudes and higher level cognitive branching ability. The student responses will be influenced by antecedent training, incidental or extraneous training and personal values. Simulation games are difficult and costly to design and validate, but show more promise in providing valid performance data if they are based on the requirements of actual professional practice.

d. *Project assignments*. These involve the production of a project such as a research paper, lab experiment or physical object such as a pharmaceutical preparation. Unlike the simulation procedure, the outcome or product is considered to be more important than the process if developed within defined parameters. The student is allowed to work independently over a period of time and could be involved in complex problem solving behavior. The resulting product must be reflective of the desired performance. Judgmental standards against which the product will be compared must allow for objective measurement.

e. *Oral examinations*. These require the student to respond orally to verbal or written questions presented by an individual or small group. The responses of the student, usually under artificial pressure, reflect verbal acumen as well as ability to process data, select and apply principles, and make judgments within tight time constraints. This measurement format is best utilized when the provision of "on the spot" extemporaneous responses to questions and alternative solutions replicates real world practice. The examiner has maximum flexibility to branch questions in order to accurately ascertain depth of knowledge.

A major weakness could be personality conflict between examiner and examinee. The subjectivity of judgments is a problem unless a clear consensus of opinion is obtained on specific standards of expected performance which are publicly known by the student as well as the examiners. The accuracy and comprehensiveness of the students' responses will be significantly affected by their critical listening skills, by the speed with which they can process the data, weigh alternatives and propose solutions, and by their ability to communicate their ideas.

g. *Observational reports*. These are systematic records of student performance over an extended period of time (3-6 months) in a "real world" setting such as a clinic, laboratory or pharmacy extern site. Obtrusive and unobtrusive observations are made of student performance by supervisors, preceptors, external raters through periodic visitations and by peers. These observations are recorded on behavior rating scales or check lists. The student could also be allowed to self-rate behavior on the same scales or check lists for later comparisons. Observational reports are best used when the environmental conditions cannot be controlled or condensed in time and when expected performance must occur in a natural setting over long periods of time. Because many of the "events" which will occur in this setting will be new to the student, a certain amount of trial and error will probably take place and must be allowed for in the behavior ratings. This technique will provide a reliable source of performance data. However, the setting must allow for appropriate practice of all of the professional competencies. Unless there are multiple raters recording the behavior of the student, the resulting data is subject to rater bias.

PLANNING FOR THE ASSESSMENT CENTER

It has been shown that grades and grade point averages as summative measures do not predict future performance in the health professions.[23,24] This has also been corroborated through correlation studies of grades and occupational success in the service, technical and research fields.[25,26,27,28,29] Reporting on the use of grades as the sole proxy measure as being fallacious, Jacobs states,

> "...We seem to have been quite contented to measure what is easily measurable rather than what might be valid but difficult to measure. In that context, it appears to be noteworthy that student's preprofessional and professional grades had been shown not to be correlated with their 'productivity' and 'success' after graduation. Therefore, one might conclude, that grade point average, one of the most frequently used proxy measures of educational effectiveness, does not reflect the real-life quality 'of educational outputs.'"[30]

Measures of the complex, multidimensional behaviors which will be required in real world practice cannot be reported in the form of grades, which are too often interpreted as the sole predictor of success. Grades reveal little about real competence since the above cited studies have shown that grades only correlate with other grades. In view of these arguments, alternative student assessment procedures were sought which might have a high degree of correlation with performance in professional practice. However, paper and pencil tests will not be abandoned in this quest. It is clear that this kind of incremental classroom measurement (primarily cognitive, and usually at the knowledge level) is and will always be necessary to ascertain student progress from one unit or course to the next. The issue is not paper and pencil testing vs. simulations or other types of assessment procedures, but the recognition that these necessary proximate measures, when summed, do not indicate a student's ability to *integrate* the individually learned knowledge, skills and attitudes—which is the ultimate purpose of the pharmacy curriculum.

In a comprehensive approach to measurement, care must be taken also to consider prior student performance, intelligence factors, personal and interpersonal attributes, individual differences and complex interreactions among groups of closely interrelated performance objectives. This approach has been noted in the analysis of orthopedic board examinations when the researchers concluded that it was essential to supplement the otherwise reliable written examinations with other techniques in order to obtain valid data on *all* of the essential aspects of competence in the specialty.

> "The data raises serious questions about the common practice of using multiple-choice questions as the sole output measure in many educational programs, especially those which have as their objectives, the development of professional competence."[31]

Based on their research the American Board of Orthopedic Surgery began using, in addition to paper and pencil tests, a variety of simulation and observational approaches to assess overall competency. In essence, this group approached an assessment center methodology much as it has been planned in this project. The assessment of professional competence through the use of patient management simulations in combination with other measures is well established by the National Board of Medical Examiners.[32,33]

After reviewing the rich variety of possible assessment techniques available, it was determined that a combination of procedures including paper and pencil tests, both cognitive and attitudinal, together with performance measures would provide the most valid and reliable data for student assessment and curriculum improvement. Observations of the student's performance should be in a real world setting or a simulation. Dr. Douglas Whitney, Director of the Evaluation and Examination Service at the University of Iowa, writing in "A Flexible Design for Health Profession's Education" reinforces this point of view.

> "The domain from which test items and clinical tasks for evaluation should be chosen is the intersection of the expected accomplishments in professional practice and the content of the particular instructional unit. This is exactly the domain from which instructional objectives should be drawn, so we may simply suggest that tests and other evaluation instruments should measure whatever the instruction should be equipping the student to know, do and be."[34]

In cases where it is more economical to simulate real world practice situations for assessment purposes, care will be taken to preserve the content validity of the assessment situation. But content validity alone does not suffice. Proxy measures which have a high probability of predicting future professional performance must be developed. This too is reinforced by Whitney.

"In order to predict ultimate accomplishment, we need to focus, in our instructional and evaluation plans, on proximate objectives that are logical and empirical 'stand-ins' for later professional performance. Our evaluation instruments should predict performances in later practice as well as document the learning resulting from the instruction just completed."[35]

Whitney goes beyond the traditional subject matter orientation of testing of the most significant knowledge domains and strongly suggests that serious consideration must also be given to the relevant aspects of professional practice in determining what constitutes valid student assessment. These concepts are consistent with the definition of "competency" in this project inasmuch as they provide a conceptual framework for integrating complex practice behaviors with the prerequisite knowledges, skills and attitudes which should lead to these practice behaviors.

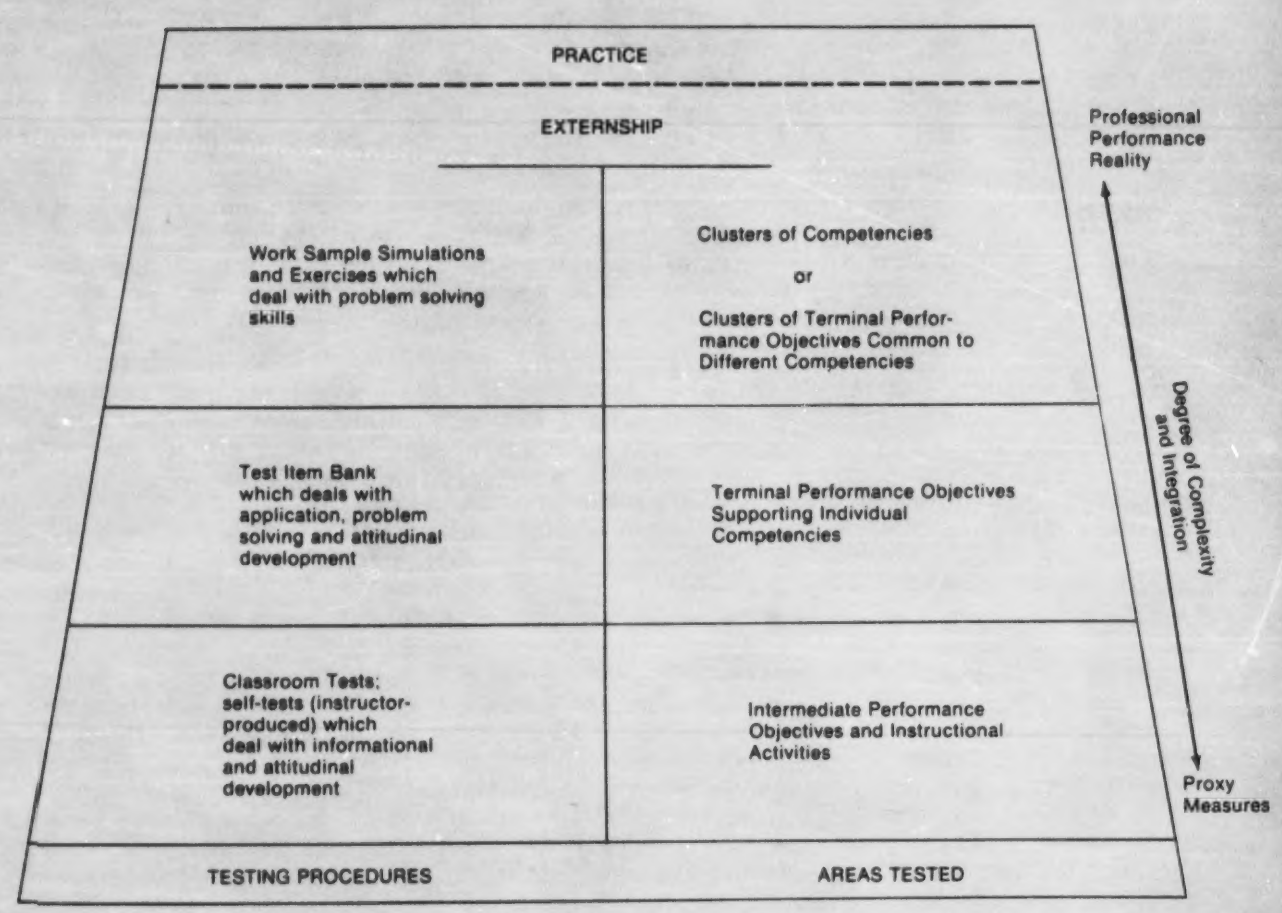
A review of the literature together with personal experiences of members of the Curriculum Improvement Office staff revealed that the most comprehensive work in total assessment of performance was currently being reported in the management and personnel fields. Multi-method and multi-rater procedures are used in these fields to identify deficiencies of professional and management personnel for development purposes, as well as to predict success in future performance, usually as a manager.

The concept of an assessment center as originally developed for the management selection/placement process has evolved into non-management uses with emphasis on individual assessment and development. However, the basic concept and structure have remained reasonably constant. Because this technique has been called an assessment center, it unfortunately conjures up the image of bricks and mortar in the minds of many. It is not a physical entity, although different types of assessment may require different types of environments. The assessment center concept is a methodology whereby varied data about student ability and performance can be collected, reviewed and integrated in such a way as to make judgments about the students' competency levels. This allows students to demonstrate their abilities to integrate and practice complex behaviors (previously tested by independent proxy measures) in a simulated, time-and-event-controlled environment. Simulations of the real world environment are based on work samples and assess a student's performance on clusters of competencies or clusters of terminal performance objectives common to several competencies. If a competency requires performance (such as teaching, consulting, communicating or interrelating) combined with professional judgment, then the student must be assessed in a performance environment where individual cognitive, affective and psychomotor behavioral components of those performances can be measured comprehensively as they interrelate in real life. These complex behaviors can be assessed by behavior-specific measures which define performance in clear scale values attached to behavioral descriptions. The use of an assessment center will allow the direct observation of a student selecting which skills he or she will have to process (cognitive, affective, psychomotor) in order to: integrate these skills to produce alternative solutions; select the most appropriate and practical solution; implement the solution and evaluate the results.

Critical performance dimensions have been tentatively identified. A student or small group of students will be presented with a series of simulated situations (designed to reflect the elements of the dimension) to which they will respond in the presence of specially trained observers or assessors (faculty, practitioners and upper level students). The assessors will observe and record the behaviors of the student, then sort and record these behaviors according to the different dimensions which have been accepted as critical. All of the observed behavioral data will be discussed, reviewed and compared with other assessment data. Initially, until reliability and validity of measures can be well established, individual assessment center performance data will be kept confidential and be provided to the student only. Overall group data could indicate needs to add or modify components in the curriculum and thus would be used as part of the curriculum development process. Eventually, as the concept evolves, plans call for the total assessment center data to be used for interim and summative assessment of student competence and, once made reliable and valid, to be used as a predictor of future practice competence (an ultimate longitudinal measure).

Total data which will ultimately be used in the assessment center will be combined from: instructor-produced classroom tests of basic knowledge; paper and pencil tests of application and problem solving generated from the test item bank;[2] attitudinal measures developed and used by the Social Curriculum Project;[3] simulations, assessment exercises and other paper and pencil instruments developed for the assessment center process.[4]

FIGURE 2—CENTER FOR THE ASSESSMENT OF STUDENT COMPETENCE.


PRACTICE
EXTERNSHIP
Work Sample Simulations and Exercises which deal with problem solving skills
Clusters of Competencies
or
Clusters of Terminal Performance Objectives Common to Different Competencies
Test Item Bank which deals with application, problem solving and attitudinal development
Terminal Performance Objectives Supporting Individual Competencies
Classroom Tests; self-tests (instructor-produced) which deal with informational and attitudinal development
Intermediate Performance Objectives and Instructional Activities
TESTING PROCEDURES
AREAS TESTED
Professional Performance Reality
Degree of Complexity and Integration
Proxy Measures

Given the model of a competency shown in Figure 1, the relationship of different assessment methodologies to the hierarchy of objectives and performance can be shown in Figure 2. A Center for the Assessment of Student Competence embraces all measurement, from the important paper and pencil tests developed for classroom use to the highest-level simulations or performance ratings.

A measure which holds the greatest potential for measuring dimensions of performance which are not addressed in other instruments is the Behaviorally Anchored Rating Scale. This instrument permits expert observers to rate student behaviors by comparing them with critical practice behaviors which have been scaled according to their positive or negative attributes as determined and validated using large groups of practice experts. Examples selected from nine categories of behavioral dimensions include these two from the National Board of Medical Examiners:[36]

History

- Obtaining information from patient.
- Obtaining information from other sources.
- Using judgment.

Continuing Care

- Following the patient's progress.
- Modifying treatment.
- Planning effective follow-up care.

Examples of behavioral dimensions from the field of management include:

Creativity: Ability to generate, recognize and/or accept imaginative solutions and innovations in management situations.

Leadership: Effectiveness in getting ideas accepted and in guiding a group or an individual toward task accomplishment.

Initiative: Actively influencing events rather than passively accepting; self-starting. Takes action beyond what is necessarily called for. Originates actions rather than just responding to events.

Planning and Organization: Ability to efficiently establish an appropriate course of action for self and/or others to accomplish a specific goal, make proper assignments of personnel and appropriate use of resources.

Problem Analysis: Skill in identifying problems, securing relevant information and identifying possible causes of problems.

Adaptability: Ability to maintain effectiveness in different situations, handle changing responsibilities, live and work in different areas under different circumstances.

Based on over 800 critical incidents identified by 34 faculty members and practitioners, nine performance dimensions have been *tentatively* identified for pharmacy practice. Each dimension summarizes scores of critical incidents of exemplary, average or unacceptable performance along that dimension.

PROFESSIONAL PERFORMANCE DIMENSIONS

1. *Selecting prefabricated products and drug components of high quality* (evaluating drug and source against professional standards; using sound judgment in selecting drugs, medical/ surgical devices and supplies).
2. *Compounding prescriptions*.
3. *Dispensing prescriptions* (receiving and evaluating orders, filling orders, preparing labels, refilling orders).
4. *Monitoring and evaluating drug therapy* (using patient records; identifying therapeutic irregularities).
5. *Communicating and counseling with patients* (on selection, use and effect of OTC drugs, prescription legend drugs and medical/ surgical devices; providing poison control information; referring patients to other health care professionals).
6. *Communicating with health care professionals* (consulting/ cooperating).

7. *Managing a pharmaceutical service* (supervising personnel; controlling inventory; managing fiscal matters; keeping accurate records; setting management policy).
8. *Maintaining drug information* (identifying, locating, and evaluating appropriate drug information through references; participating in continuing education programs.
9. *Maintaining professional and ethical standards* (complying with the laws and regulations; professionalism).

These performance dimensions were derived from the 34 competencies which have been previously validated in a job analysis.[5] Not all of the critical incidents which were generated related to observable validated performances of pharmacists. Eleven personal trait dimensions were also tentatively identified. Although this type of dimension does not describe types of performances, it does summarize clusters of incidents which serve to describe the quality of performance.

PERSONAL TRAIT DIMENSIONS

1. *Oral communication skills* (speaking, persuading, listening).
2. *Written communication skills*.
3. *Human relations skills* (patient-centeredness, interpersonal skills and sensitivity).
4. *Organizing and planning*.
5. *Decision making and practical judgment* (problem solving).
6. *Personal impact* (impression left with patients, appearance).
7. *Detail-mindedness* (thoroughness, follow-up and documentation).
8. *Independence* (assertiveness, self-confidence).
9. *Behavioral maturity* (stress resistant, flexible, adaptive, resilient).
10. *Work orientation* (initiating, self-motivated).
11. *Social conscience* (community and civic-minded).

Behaviorally anchored rating scales are being developed for each of the performance and trait dimensions. Figure 3 depicts a typical behaviorally anchored rating scale as used in the nursing profession.

The earliest reported use of behaviorally anchored rating scales in assessing pharmacy practice involved pharmacy clinical residents at the College of Pharmacy, University of California, San Francisco.(38) The application was in the clinical practice setting only and differed from earlier techniques in three areas.

1. Several of the critical incidents were not behavioral in nature. The study was based on 'critical characteristics' rather than on critical behavioral incidents.
2. The retranslation procedure involved participating staff and residents rather than a group of practitioners outside the school.
3. Residents received copies of the scales in advance of their evaluations. Thus the scales have been used in a behavioral self-evaluation process.

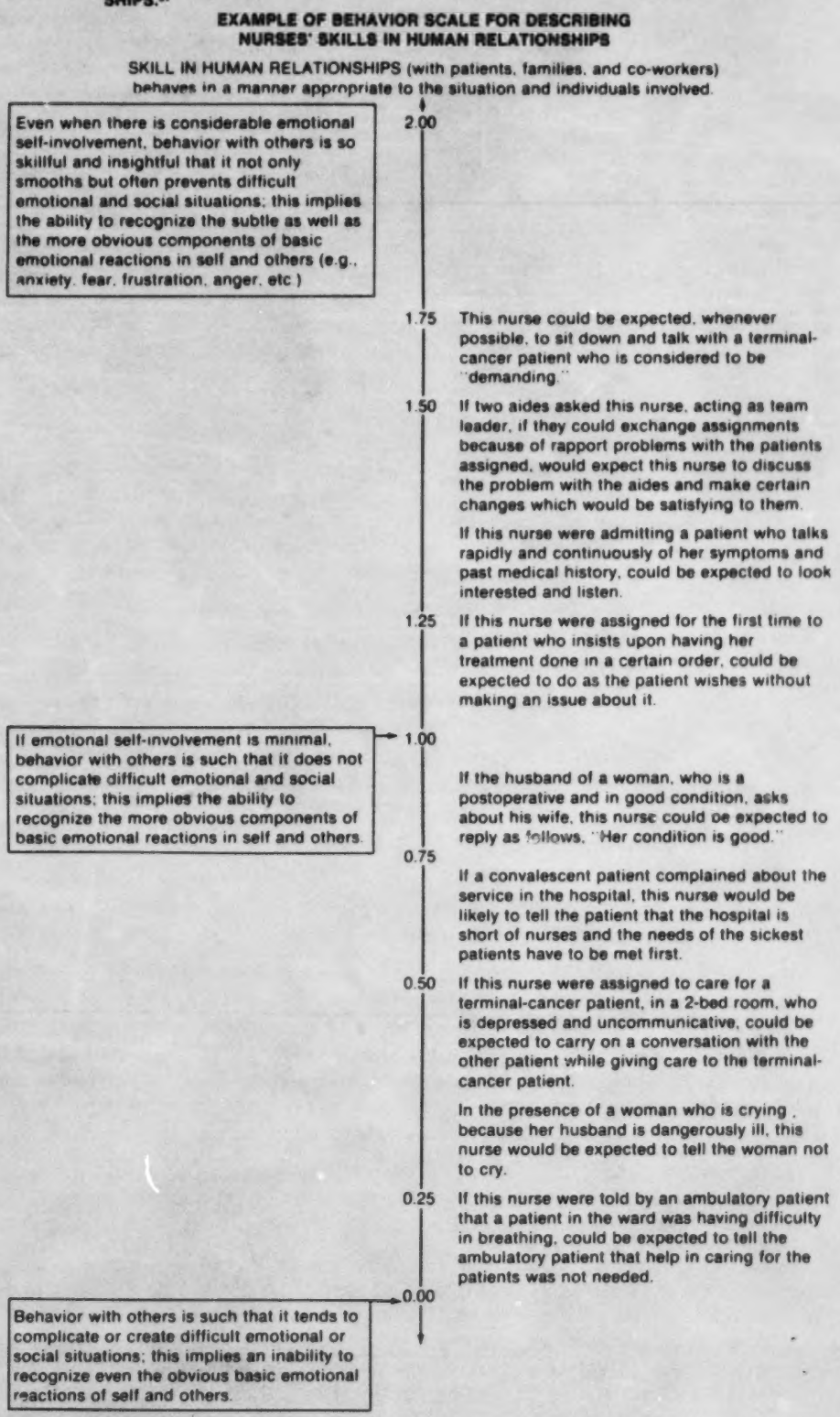
The California authors have identified several expanded applications for the procedure.

1. Review of any clinical pharmacy practitioner.
2. Review of clinical pharmacy teaching staff.
3. Review of clinical pharmacy clerkship performance.
4. Review of performance of applicants to a residency program.
5. Review of potential specialists in a certification program.

One of the applications is in process--the development of scales for evaluating performance in the clinical pharmacy clerkships. Other useful outgrowths of the process of developing the original scales include:

1. The opportunity to focus the behavioral objectives of pre-clinical courses toward the 'critical characteristics' in the scales.
2. The increased reliability and validity in the use of the scales by faculty members who participated in their development.[6]

FIGURE 3—EXAMPLE OF BEHAVIOR SCALE FOR DESCRIBING NURSES' SKILLS IN HUMAN RELATIONSHIPS.[37]


EXAMPLE OF BEHAVIOR SCALE FOR DESCRIBING NURSES' SKILLS IN HUMAN RELATIONSHIPS
SKILL IN HUMAN RELATIONSHIPS (with patients, families, and co-workers) behaves in a manner appropriate to the situation and individuals involved.
Even when there is considerable emotional self-involvement, behavior with others is so skillful and insightful that it not only smooths but often prevents difficult emotional and social situations; this implies the ability to recognize the subtle as well as the more obvious components of basic emotional reactions in self and others (e.g., anxiety, fear, frustration, anger, etc.)
2.00
1.75
This nurse could be expected, whenever possible, to sit down and talk with a terminal-cancer patient who is considered to be "demanding."
1.50
If two aides asked this nurse, acting as team leader, if they could exchange assignments because of rapport problems with the patients assigned, would expect this nurse to discuss the problem with the aides and make certain changes which would be satisfying to them.
If this nurse were admitting a patient who talks rapidly and continuously of her symptoms and past medical history, could be expected to look interested and listen.
1.25
If this nurse were assigned for the first time to a patient who insists upon having her treatment done in a certain order, could be expected to do as the patient wishes without making an issue about it.
If emotional self-involvement is minimal, behavior with others is such that it does not complicate difficult emotional and social situations; this implies the ability to recognize the more obvious components of basic emotional reactions in self and others.
1.00
If the husband of a woman, who is a postoperative and in good condition, asks about his wife, this nurse could be expected to reply as follows, "Her condition is good."
0.75
If a convalescent patient complained about the service in the hospital, this nurse would be likely to tell the patient that the hospital is short of nurses and the needs of the sickest patients have to be met first.
0.50
If this nurse were assigned to care for a terminal-cancer patient, in a 2-bed room, who is depressed and uncommunicative, could be expected to carry on a conversation with the other patient while giving care to the terminal-cancer patient.
In the presence of a woman who is crying, because her husband is dangerously ill, this nurse would be expected to tell the woman not to cry.
0.25
If this nurse were told by an ambulatory patient that a patient in the ward was having difficulty in breathing, could be expected to tell the ambulatory patient that help in caring for the patients was not needed.
0.00
Behavior with others is such that it tends to complicate or create difficult emotional or social situations; this implies an inability to recognize even the obvious basic emotional reactions of self and others.

Scores of other examples could be provided from the psychological literature, however, the intent is to show the range of possible dimensions. The pharmacy performance and trait dimensions which have been tentatively identified from the existing validated competencies were developed through the use of critical incident procedures as recorded by Flanagan.[39] Scaling techniques, where appropriate in observational assessments, will be used to provide multidimensional measures of behavior.[40] Simulation exercises will be based on the dimensions and critical incidents.

DERIVATION OF BEHAVIORALLY-ANCHORED RATING SCALES (BARS)

BARS are primarily used to assess on-the-job performance and are adaptable to the descriptive elements of criterion-referenced tests which can be used effectively to determine the student's entry level (to the job) capabilities.[41] The intention of the latter is to describe the status of a student relative to a predetermined validated standard of performance. The principal advantage of BARS is that its development requires the input of highly informed faculty and practitioners to identify relevant and valid professional dimensions, thus enhancing scale reliability and validity.

Steps for BARS Development

1. *Identify critical incidents:* Critical incidents of professional performance are described in specific behavioral language. This differs from task description or discrete behavioral objective statements in that experts describe a continuum of effective and ineffective performance behavior with specific examples from the speciality under review. This procedure provides an accurate picture of the quality of professional performance. Typically, hundreds of these incidents are noted. This project has identified over 800.

2. *Derive performance dimensions:* Experts in the field (faculty and practitioners) cluster all recorded incidents into smaller sets of performance dimensions (5-10). This is a matter of professional judgment which is influenced by background, training and experience.

3. *Retranslate the critical incidents:* A second group of experts (faculty and practitioners) is given the performance dimensions and asked to assign them to those critical incidents which they best describe. A specific critical incident is retained if 50-80% of this second group assigns it to a dimension.

4. *Scale critical incidents:* This second group of experts is then asked to rate on a seven-or nine-point scale how effectively or ineffectively the behavior described in the critical incident represents the overall performance in the dimension. A standard deviation is then computed for each of the ratings to determine the degree of agreement among the raters.

5. *Design the final instrument:* Those incidents (usually 6-7 per behavioral dimension) which meet both the retranslation (Step 3) and standard deviation criteria are used as BARS.[42,43,44,45,46]

Figure 4 depicts a model for an assessment center process which provides student feedback for personal development, feedback for redesign of instruction, and, after validation, data for certification of competency. Assessment exercises may be selected to measure groups of terminal performance objectives, single competencies or clusters of competencies. During the developmental phases of the center, validation of all exercises will be conducted so the combination of measures can ultimately be used for making pass/recycle judgments about students. In the meantime, data about groups of students may be fed back to the faculty for instructional modification and to individual students for diagnostic feedback and counseling purposes.

The assessment exercises may be used to pre-assess students before their externship experience. Substandard areas of performance would be stressed in the externship, and post-tests would be administered in preparation for competency certification. Feedback loops at all points permit remedial experiences.

An independent, competency-based examination by the state boards of pharmacy could provide additional assurances that competency has been achieved in the interest of public safety. Continuing education is shown in the model as a continuous cycle involving feedback between what is incidentally learned in practice and what is planned learning subsequent to a learning needs assessment. Assessment exercises may also be made available to the mid-career professional to provide assistance in maintaining or increasing competency through continuing education as it is now offered or through re-entry into the educational system.

Several issues arise as the assessment measures are being developed. These issues, however, are not unique to the development of these new measures, but apply to currently used tests and performance observations as well.

1. How are proficiency levels or cutting scores established which reflect the difference between the competent practitioner and the novice?
2. How does the reliability of behavioral rating instruments and other assessment exercises compare to that of paper and pencil tests?
3. How long should the combined assessment exercises be, and how often should a student be exposed to the exercises?
4. How can assessment center data be validated to predict future performance?
5. What proxy measures should be investigated for concurrent validity?
6. Is the assessment center method cost effective?

This concept of student assessment is approached in the spirit of developmental research. It is hoped that many significant issues of assessment within the context of competency-based curriculum development may be adequately addressed in this developmental project. Answers to the questions posed above will be sought in this spirit.

FOOTNOTES

[1]Psychometrists refer to several kinds of validity: content validity, concurrent validity, predictive validity and construct validity. For a discussion of the several kinds of validity, see Mehrens, W.A., and Lehmann, I.J., *Measurement and Evaluation in Education and Psychology*, Holt, Rinehart and Winston (1973) pp. 124-136.

[2]A computerized test item bank is under development by Minnesota Systems Research, Inc. Test items are based on the terminal performance objectives derived from a content analysis and have been contributed by practitioners and faculty members from this college and selected other colleges of pharmacy.

[3]The Social Curriculum Project is an experimental patient-oriented curriculum which emphasizes behavioral and communicative skills as an integral part of pharmacy practice. In addition to the standard curriculum, selected students receive enriched instruction and experience designed to lead to patient-oriented pharmacist behaviors.

[4]Examples of assessment exercises include "in-basket" exercises to measure management skills, programmed testing of the branched type to measure problem solving skills, oral presentations, leaderless group discussions, dispensing exercises, dispensing simulations, and extern performance reviews utilizing behaviorally anchored rating scales.

[5]The 34 validated competencies were referred to as "must have" competencies. They are the essential competencies a practitioner must exhibit to be competent in today's practice. Later, 14 "should have" competencies were identified to describe those competencies which panelists felt all pharmacists should be performing within the next five years.

[6]Jacoby, K., personal communication (7 March 1977), College of Pharmacy, University of California, San Francisco, California, 94143.

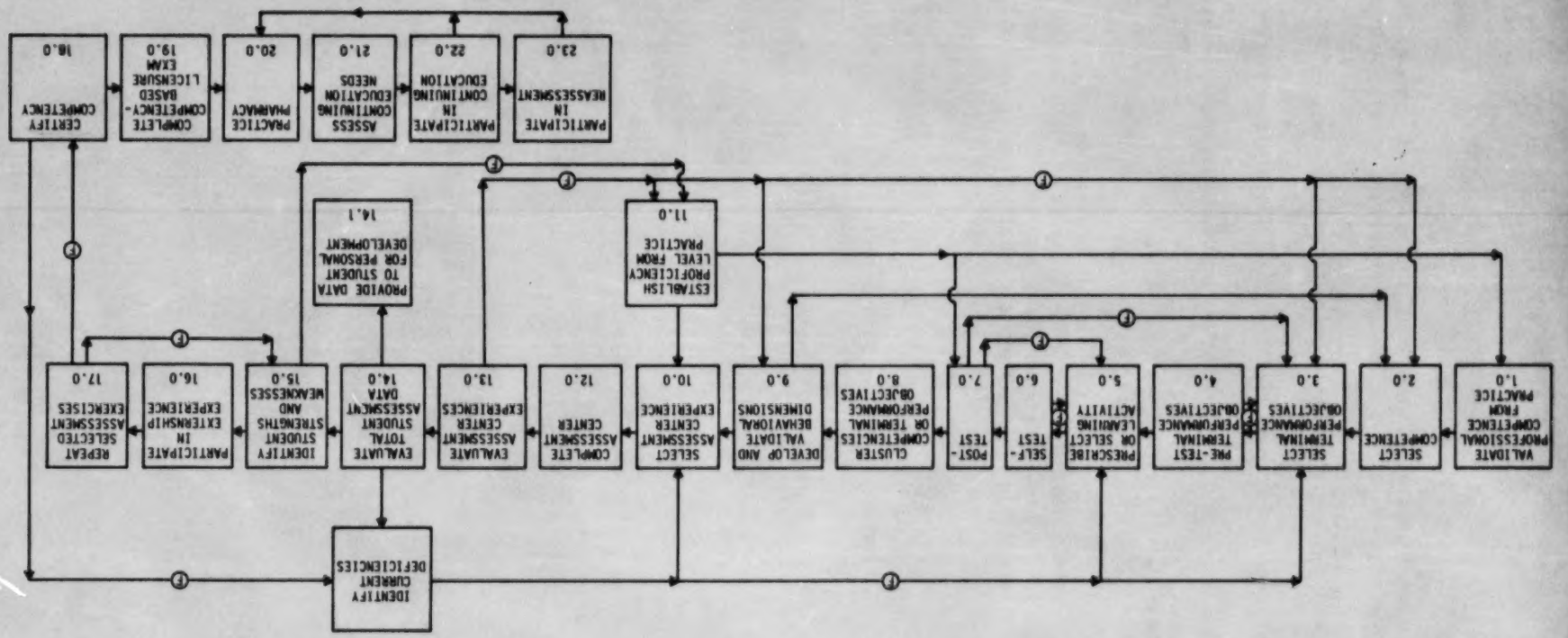

1.0 VALIDATE PROFESSIONAL COMPETENCE FROM PRACTICE
2.0 SELECT COMPETENCE
3.0 SELECT TERMINAL PERFORMANCE OBJECTIVES
4.0 PRE-TEST TERMINAL PERFORMANCE OBJECTIVES
5.0 PRESCRIBE OR SELECT LEARNING ACTIVITY
6.0 SELF-TEST
7.0 POST-TEST
8.0 CLUSTER COMPETENCIES OR TERMINAL PERFORMANCE OBJECTIVES
9.0 DEVELOP AND VALIDATE BEHAVIORAL DIMENSIONS
10.0 SELECT ASSESSMENT CENTER EXPERIENCE
11.0 ESTABLISH PROFICIENCY LEVEL FROM PRACTICE
12.0 COMPLETE ASSESSMENT CENTER
13.0 EVALUATE ASSESSMENT CENTER EXPERIENCES
14.0 EVALUATE TOTAL STUDENT ASSESSMENT DATA
14.1 PROVIDE DATA TO STUDENT FOR PERSONAL DEVELOPMENT
15.0 IDENTIFY STUDENT STRENGTHS AND WEAKNESSES
16.0 PARTICIPATE IN EXTERNSHIP EXPERIENCE
17.0 REPEAT SELECTED ASSESSMENT EXERCISES
IDENTIFY CURRENT DEFICIENCIES
18.0 CERTIFY COMPETENCY
19.0 COMPLETE COMPETENCY-BASED LICENSURE EXAM
20.0 PRACTICE PHARMACY
21.0 ASSESS CONTINUING EDUCATION NEEDS
22.0 PARTICIPATE IN CONTINUING EDUCATION
23.0 REASSESSMENT PARTICIPATE IN

FIGURE 4—MODEL FOR ASSESSMENT PROCESS.

H14

3.0 This is one of several terminal performance objectives supporting the competency. A terminal performance objective is an end of unit or module outcome. It usually addresses higher levels of behavior, such as application or problem solving.

5.0 Learning activities address all modes of instruction: live lecture; P.S.I. unit; modular; film; programmed instruction; independent study, etc.

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SECTION I
ORAL PRESENTATIONS

DAVID GARLOFF

The lecture method can be an extremely effective technique if you have taken the proper planning steps and understand what it can accomplish. For the experienced instructor, motivation for planning lectures usually diminishes over the years because it is a repetitive task. Unless new knowledge is generated in the topic area, one is apt not to revise every new lecture. This usually results in less enthusiasm for delivering the talk. When this happens a major advantage of the live oral presentation is lost. The lecture can create a climate of excitement and enthusiasm about a topic with which students will sympathize and then will translate into a guide for their own study of the subject. In short, the lecture can motivate learning.

PLANNING: The question, then, is how do I maintain a vitality in the planning process so it is also exciting and pertinent to my needs? It should be neither a repetition of past planning nor should it be a time-consuming burden. I have found several key things which help maintain interest in planning and which might provide some answers.

1. Always view the student group as a participant in the planning of a lecture.
2. Use feedback from previous talks to help plan new presentations.
3. Do not account for every detail of what is to be said in the presentation.
4. Plan the presentation as if it were a performance rather than an outline of content.
5. Collect ideas for planning talks.

Using Students: Just as individuals are different, so are groups. I am sure you have reflected over the years how one class as a group differed from another. Each group or audience can collectively be thought of as having unique qualities. It may be a very talk-oriented group or it may be process-oriented and never seem to produce a product. It may also be a group of independent workers. People with a variety of needs may be in the class for a variety of reasons. You will want to explore *with* the group members who they are so you can direct your planning of future talks with that group. If you meet the group only once, you will want to plan some activity which gives you immediate information about the group and how they might shape the way you are going to present the day's information or concepts. This exercise might also tell you the content areas to emphasize or even what to eliminate. Although it sounds like on-the-spot planning, the process of letting the group's character influence the *way* you present can be crucial.

When I will be meeting with an audience for only one time, I sometimes ask the class to break into groups of five and have each small group devise three questions they might have about the topic of the day. I explain they need not have any previous background on the subject—I just want to see where they are coming from. I then have them put these questions on a sheet of acetate for the overhead projector. In this way I can get an idea of what the group's language is relative to the subject, their perceived need of and interest in the subject, the priorities for questions and the complexity of the presentation required for them. It also provides the whole class with a provisional commitment to find answers to the questions by listening to what you have to say or demonstrate. Your task as instructor is then to point out what you had in mind to present and how it will help them get answers to those questions. Very often at the end of the presentation, you may project the acetate transparencies on the screen again to see *with* them whether their questions were answered and whether questions you posed in addition have been dealt with adequately.

Obviously, this illustration does not apply to a class which meets repeatedly over several weeks. The point, however, is clear. Involve the students in planning whenever possible. You can probably think of other ways. Take a quick oral poll of the class to find what difficulties they are having, what are their anxieties, what is their level of apathy, etc. You will soon learn how to plan effectively with this kind of in-class participation.

Use of Feedback: What was just said borders on this second idea of using feedback. Some instructors, at the end of each lecture, give the students a 3x5 feedback card and tell them to write anything that is on their mind as a result of the presentation. This furnishes you with information of all kinds. It might, however, be better to provide structure by asking them to signify the least understood part of the presentation, the part they want repeated or if there was any needless repetition. Once you start doing this as a routine, you will think of many additional questions or ways of getting regular feedback outside of simply testing them over the content. Remember, what you are primarily interested in with this technique is learning how well you are communicating. Do not expect them to have learned the information yet. Rather, were you clear to them about what was said, shown or done in the lecture? When you know this, then seek to modify the way you deliver the presentation, and in some cases, reevaluate the need for them to know the content.

Organizing the Content: You have heard the expression that there is no such thing as overplanning. When preparing a lecture, you can, however, define the detail of your presentation so precisely that reading the material is the only way you can deliver what you have planned. When this happens, you have, in a sense, overplanned or misused the plan. The key to an enthusiastic lecture is that it be extemporaneous. The best advice for achieving extemporariness is not to use written notes. But if you do not use notes what do you use to plan the lecture mechanically? The answer is best given in the following way.

Performance Outline: Plan your presentation as if it were a performance rather than an outline of content. Afterall, you really are the content expert. You do not need the information in front of you when delivering the talk. What you do need, however, are the cues which will trigger your mind to relate information, examples and ideas to the group. By this I do not necessarily mean topic outlines. You may just have a sequence of 2x2 slides or overhead transparencies or newsprint sheets. The media you use can organize your action sequence. Not only does the medium tell you what to say, but it can also suggest the method of making transitions. Just the act of changing slides denotes a change in subtopic, next step or new bit of explanation. You will not have to remember when and how to make topic transitions. The medium does that for you or cues you to do it. By making the media component of your lecture serve to visualize and summarize your ideas, it also functions to organize the presentation. Thus, when you write your outline, you will talk first about introducing the subject of X with the overhead series and then demonstrating with slide series Y, etc. The plan is much more abbreviated and pertinent to what you must do, not what you must say. If you deliver the same lecture several times, you will also find that it is much easier to maintain enthusiasm because you spend more time relating to the group than referring to notes. The consequence of this is an extemporaneous delivery.

Ideas For Doing The Talk: Much of what was said so far assumes you know what you are going to say and how you are going to deliver the talk. However, there is a creative component of planning a lecture which relates to how you illustrate a point, how you interject levity, how you begin a topic, how you obtain audience feedback and how you provide a challenge to the listeners. All of these attributes of a lecture (and there are lots more) require more than just knowing the content. So you have to pull from a pool somewhere some techniques for doing the above things. My suggestion is that you start collecting an idea file where you can catalog ideas obtained from other lecturers and the mass media. The file might have the following headings:

Summarization techniques
Personal illustration techniques
Levity techniques
Kick-off techniques (beginning the lecture)
Feedback techniques
Small group techniques
Transition techniques
Techniques for demonstrating
Visualization techniques
Closure techniques

As you gather ideas from observing others and from your own experience, you will develop a breadth of ideas to stimulate the planning of new lectures. Much of this file is a matter of being sensitive to seeing the techniques around you. If you are consciously aware of the above ten categories you will probably create a large file over a very brief period of time. To give you an idea of what each category might contain, the following discussion expands on the meaning of each heading.

Summarization Techniques: Think in terms of summarizing many times during a lecture. Marshek1 explains that the good lecturer, as judged by student comments, is one who summarizes periodically throughout the lecture. After each major point, it should be briefly revisited and reviewed.

However, do not think of summarization as purely a verbal task. It can have both visual and physical characteristics. If you are finished explaining a point and want to summarize, physically move to another place in the classroom. Move to another portion of the chalkboard and summarize by writing on the chalkboard. Or go to the easel which has newsprint and reveal a prepared summary. The physical movement away from the area of explanation to an area of summarization provides a transition. It is a subtle way of implying structure to the viewer. You can create the visual summary on overhead transparencies ahead of time or you can ask the students to suggest the elements of the summary and write on the acetate as they comment. Whatever method you choose, remember to plan the summarizations frequently, with physical characteristics, visual components and, sometimes, with audience participation.

Personal Illustration Techniques: By virtue of your position on the faculty you have instant credibility for being a valuable resource, an expert and knowledgeable individual. You also have the distinction of a set of life experiences which led to this expertise. It would be unwise to not share these with your students. One of their expectations is for you to share these experiences with them. It is one of the things they think you have to offer.

Thus, personal illustration is important for more reasons than just clarifying a point. It may be even more important because your role is partially defined by your valuable personal experience. So when planning presentations, identify personal experiences which illustrate a point or concept. It will make your presentation more persuasive. There really are no techniques as such. One can tell a story or relate an incident, but generally personal illustrations are rewarding to students if they occur at the proper frequency and at the appropriate times during the presentation. Probably the greatest danger of the personal illustration is that it can be used too often. Use it too often, and the students will lose the thread of your structure. If used at the wrong time—such as in the middle of an explanation detailing the steps in a process—it can cause disjuncture in the chain. Contiguity of the elements in the chain may have been important to understanding the process.

Levity Techniques: Gesturing, using a visual illustration of the negative consequence for a positive verbal statement, joking about a point in the presentation, and reflecting satirically on a goof you made in a presentation are all techniques which introduce levity into the presentation. Given any one lecturer's personality, any number of specific methods can be used. You will have to formulate your own specific method of introducing levity—one which utilizes your personality in the most positive way.

Two cautions should be made, however. First, be sure any humor is not the result of a put-down of either someone in the class or outside the class. This can only act to hurt someone. It will needlessly raise anxiety in some members of the class and disrupt the focus on the subject. Second, try to avoid using jokes which have no relationship to the subject of the presentation. The purpose of introducing levity is not to entertain but to provide a break and variation in listener concentration. The business of listening can be exhausting, and it requires occasional mental coffee breaks. However, if you stray too far from the subject by using unrelated jokes, it will be difficult to get concentration back on the subject.

Kick-Off Techniques: If you plan in detail any portion of the lecture, plan the beginning. I already mentioned the small group technique of soliciting questions. This is good for defining the needs and interests of the group. Another often used kick-off technique is to summarize what was discussed at the last session. Educationally, this is very sound, and it can be counted on to establish the continuity of study from one day to the next. Learners look for structure. If you summarize, you build a context for looking ahead and satisfy the student's quest for meaningfulness of what will come. This is what is meant by structure. The teacher must continuously back up to review the whole so there is context for the parts. Summarization at the beginning of the oral presentation will provide a good structural context.

Another kick-off technique establishes a common background experience for you and the learner to examine together. For instance, you may have at the beginning a short film sequence on some phase of the day's topic, You prompt the group to listen and enjoy the sequence rather than to take notes. Afterwards, however, you would spend the time commenting on what was only briefly covered in the film clip. You have started the group with a common concrete experience (e.g., film of experiments or explanation of concepts) from which you draw for presenting your ideas and information. It has provided a focus. It also has provided data or experiences which form a common starting point for the subject.

Obviously, the starting point need not be a film. It could simply be a live demonstration of clinical or laboratory reactions. It could be a filmstrip or slide-tape presentation. It could even be a handout which everyone reads at the beginning of class. The only criteria are that the experience be:

a. Brief
b. Instructional information (you will be providing structure)
c. Related to all or part of the day's topic
d. Unclear in its purpose for using in class

This last criterion requires some explanation. What you want to do is use the kick-off to raise questions, curiosity and interest in the subject. You provide the students with the raw materials and the basic question of the topic's value in preparation for what you will want to say about it later. You will, in a sense, be providing dissonant experience. Then your follow-up presentation will (through structure and explanation) relieve the dissonance and establish orderly meaning to the subject.

You can probably think of other kick-off techniques which establish the setting for the presentation. Usually the technique will stimulate curiosity, provide continuity of the parts and establish the scope of the presentation.

Small Group Techniques: Although small group activities are often thought of as a teaching strategy apart from the lecture method, it is possible to incorporate them into the lecture. This is especially so for classes in which the student is older (the graduate student) or in which long periods (i.e. 1½ to 2 hours) are involved in the lecture format.

Adults have a background of experience which should be introduced into the subject being presented. Also, adult learners will have a greater need to discuss the application of knowledge to their present work. Accommodation of this need may be possible through small group sessions. Small groups may function to:
*Help clarify concepts among learners (rather than you doing it for them).
*Apply knowledge and stimulate creative thinking on the presented subject.
*Identify needs to the instructor and students.
*Integrate the material in the lecture.
*Summarize a subtopic of the lecture.

Small groups require that you supply rules which are clear and concise. Actually, it is quite easy to use small groups in a lecture if you have planned them well and enforce the rules rigidly. Much can be accomplished in a short period of time. Here are several small group methods you might try:

Diad Technique: This technique is good to use for feedback or to get students to reflect on what was just discussed. It requires only four or five minutes. The procedure would be to tell the students to form pairs. Tell them to turn to their nearest neighbor. Then describe the task. Usually the task requires each one to talk in turn. One may have to take a positive stand toward an issue while the other will have to take a negative. Or one will try to explain the advantages of some previously introduced topic, while the other suggests disadvantages. Sometimes you will want to give each person two minutes of time to list questions or to explain a procedure just presented. The important rule, however, is that you indicate that the listeners have the responsibility to be able to report at the conclusion what they heard. Thus, after the four or five minutes, select a few people randomly and find out what they heard. After doing this, ask a few prepared questions of the whole group. For instance, you might ask if many found it difficult to describe the process. Or, could any remember the names of the steps. Etc.

By telling the listeners ahead of time that they will have to report (and it only has to be brief, without any probing), you will force everyone to take the task to heart during the diad. By asking them questions (for which you will not expect answers) after the reporting, you challenge the students to start or continue their attentiveness and disclose to them what they should be up to during their future studying. You cannot expect them to have learned the material by the end of the lecture, but in some follow-up activity you can provide them with the (1) motivation, (2) information and (3) structure for learning. Diads help fulfill these functions.

Discussion 66: This means you break the class into groups of six and give them six minutes of discussion time. It is a time-consuming technique, very structured, and designed to force everyone into participating. The entire procedure will last twenty to thirty minutes. Generally, you would start by asking a question related to something about which you were just lecturing. The question will usually require them to come up with some

ideas or a solution to a problem and will force them to do some integrating of what they heard. A sample question might be, "What are some external forces which will influence what we have just presented?" Then, break the class into groups of six. Assign one person in each group as the leader. The leaders have two responsibilities, which you explain. First, they must appoint a secretary to keep notes. Second, they must ensure that everyone has talked in answer to the question, but for no longer than one minute. Let them begin, and look at your watch as they start so they know you are timing the exercise. While they are discussing, walk around the class and occasionally glance at your watch. However, be careful *never* to get eye contact with a student in a group. If you do, it will distract and the group will not feel as intact as before. Furthermore, they may also start asking questions of you. You do not want to be part of the discussion. Walking around tells them you are listening to whether the question is being discussed. At the end of the six minutes (and you might warn the secretaries thirty seconds in advance), you end the discussion. Ask a random selection of the secretaries to report. The first secretary will probably have much to say, and you should summarize it on the chalkboard or on the overhead projector. After the first secretary, ask other reports to include items which may be new to the list. In about ten minutes you will have a long list of ideas, solutions, etc. You must summarize and focus the "content" generated by the group so it is woven into the context of your next portion of the lecture. This requires a bit of experience on your part, but if you can do it, you will have the class involved and committed to learning future material.

Brainstorming: Sometimes brainstorming in a formal setting can be extremely effective as a way of forcing students to take risks and utilize new knowledge in a variety of ways. You may seldom employ this technique because it can be time consuming and does not always lend itself to the objective of your lecture. On those occasions where it seems appropriate and time is available, you can do it by dividing the class into groups of four. Ask one person to be secretary. Ask that they come up with a list of ways, solutions or ideas in response to a problem statement, a sequence of unexplained events, etc. Provide at least fifteen minutes. Describe the ground rules at the outset. The rules are: No reality testing of suggestions, use another's suggestion for thinking of a subsequent idea, and, when at a standstill, review the charge given to the group. At the conclusion of the session, review the ideas quickly and relate them to what authorities and others have come up with in regard to the same charge.

Brainstorming is difficult as a technique, not so much because the activity itself is difficult to implement, but because the data you are supplied with at the end of the session have to be immediately put into a context and made relevant to your planned topic or revelation. This may require some tricky, on-the-spot thinking and could very easily prove inadequate to achieving your goals.

Buzz Session: If you ever have a half-day session with one group you may want to try a buzz session. This is an unstructured session in which you break the class into groups of no more than seven. The task is merely one step above social discussion. Assign them the task of sharing their understanding about the subject thus far, so clarification is possible. You, as an instructor, should visit each group for a few minutes and listen. When asked questions try to respond and then redirect with probing questions. Leave shortly after so the discussion will not become dependent on your input. Little follow-up will be necessary because you will have had a chance to visit with each group. You should summarize your visits to provide closure to the activity and then launch into the next topic.

Role Playing: Probably the least applicable technique will be role playing sessions. In this situation you are interested in having members of the small group assume a specific role which they have to act out when given a protocol. Theoretically these roles will have character because your lecture has provided the information necessary for assuming the roles. Not too many subject areas in teaching lend themselves to this approach, but it can have impact on students, especially as a terminating experience.

There are variations of these and other group techniques. As you visit with colleagues you will undoubtedly be able to add to this list of techniques.

Transition Techniques: The best and most used transition technique is the summarization, which was explained earlier. However, there are other techniques which can be used. Media provide the easiest method. By turning off the overhead projector, for instance, you automatically signal a change to the audience. Usually they turn away from the screen, focus on your face, and wonder what is next. In other words, the visual change or physical movement can make the transition.

You may ask yourself why the transition is such an important component in planning and the delivery. The transitions signify the structural elements of your lecture. Students use the change as a way of organizing their thinking about the subject. That is why it is important to motivate the change of topic through the use of transition techniques. As with a transition sentence in writing, you must show the connection between one element and the next. Otherwise it is confusing to the viewer. The student, as listener, is always trying to put two and two together. If your "performing syntax" does not help with this, you are likely to lose some of your effectiveness. Thus, when you plan a presentation, think about the transition. It should be logical. Ask yourself why you start telling them one thing first and another thing second. When you know why, note it and be ready to use that reason in your presentation.

Techniques for Demonstrating: There are simple rules to follow when using demonstrations as part of the lecture. Usually you will demonstrate how something works, a cause and effect relationship or a process. All of these imply that you will interrelate elements. For instance, you will demonstrate the action of two chemicals by actually showing what happens when they are subjected to certain conditions. Or you will show how an apparatus should be used. Any demonstration technique requires that you:

1. Simplify the interrelationship for descriptive purposes.
2. Describe the ingredients or elements to be interrelated.
3. Show the function when the elements are interrelated.
4. Summarize the action in terms of the verbal principle or concept it represents.

In planning a demonstration, first simplify the steps in the procedure or outline what you need to do to present the key elements. Then when delivering the demonstration you will first summarize the intent of what will follow, describe the ingredients of the demonstration, then show in some *sequence* the interaction or how the ingredients work together. Finally, verbally summarize what was shown, giving the visual and physical display a form of abstraction, so the learners can associate the action of the demonstration with the principle or concept being studied.

Audio-visual techniques play a significant demonstrating role. If what you are demonstrating is small and hard to see, you can magnify the elements by using overhead television. If you need to repeat the action of a demonstration, you may want to prerecord the demonstration so it will be possible to stop it and repeat segments. You may also want to demonstrate live and then show prerecorded effects of the same demonstration under different conditions. You can probably think of other applications. The point to keep in mind, however, is that you should try to use the audio-visual technique to better fulfill one of the above requirements. That is, the A-V method should help you simplify for descriptive purposes, help describe the discrete elements, illustrate the interaction of the elements or help summarize the event.

Visualization Techniques: Many lecturers planning a presentation will have a good idea of what needs to be said verbally, but will not know how to best illustrate the ideas with a visual counterpart. The best approach I have found for visualizing is to create a tearsheet file. A tearsheet is a page torn out of a magazine which contains a picture or graphic idea potentially useful in the future. As you read newspapers, magazines and journals, you will find many good examples. Save them and file them so you can retrieve them easily. When you are planning a lecture, thumb through your tearsheet file for examples which trigger ways you can visualize ideas in your talk. Sometimes you may find parts of pictures which, when put together, can meet your need. If you know how to manipulate or translate these tearsheets into 2x2 slides, overhead transparencies, handouts or charts, you can creatively and effectively illustrate your talk.

Closure Techniques: No matter what you think of the lecture method, you must still consider the act as a form of performance. Every performance has an ending. It need not be a resolution, but it is a temporary stopping point. As such, you should plan for it and make sure you leave time for closure at the end of a presentation. Planning may simply mean you decide what action will convey the idea of:

*Unfinished business
*Continuing and future application
*Summarization
*Assignment

Closure activities will usually contain these four features. Indicate that time will not allow completion or continuation, but that the students should expect unfinished business. It is important that you state this.

Otherwise, they may get the impression there has been exhaustive explanation, which is rarely the case. You should always project that thought at the closure section of the lecture. Second, indicate how what was discussed has implications for the future. This would probably involve some summary statement of what was covered. Last, tell the students what they should specifically do with this new information to help them "learn" it.

DELIVERY: You should radiate authority. You can do this by appearing relaxed, yet aloof. Think of your actions when in front of the group. Do you make commanding statements, yet remain open to feedback? Although your credibility is initially lodged in the credentials you bring to the classroom, your "performance" effectiveness can not be based forever on this factor. You will soon have to show not only authority on the subject, but authority in the instructional setting. Much authority can be achieved by planning well. A well-planned lecture will command respect from students, and in return, you will be able to assume an air of authority for the presentation.

Care should be taken to not confuse authoritarian rule with projected authority. You can project authority without being authoritarian. This is especially significant in teaching older learners, who function better in instructional settings if they have a vote to cast in making some of the instructional decisions. Thus, your authority may be projected in a recommendation of alternative test schedules, but let the class decide the exact date. You have been authoritative in your manner of presenting, but democratic in the process of achieving the objectives.

Involvement: Somehow you need to communicate that your heart is in your work—that what you have to say is important. Enthusiasm is mandatory. That is why it is better not to use notes. Notes tend to inhibit your ability to show enthusiasm. Perhaps you have noticed how television performers who read their jokes from cue cards do not seem to project the same enthusiasm as those who seem to spontaneously deliver the line.

Remember, it is unfair and unrealistic to expect your listeners to get excited about your message if you do not show that you are also excited. Two recommendations will help achieve involvement. First, "think the thought. " It is perfectly possible for a lecturer to drone on and on without a shred of realization of what is being said, especially when reciting from memory or reading a manuscript. You must think the thought! Second, use asides or ad lib comments in the form of levity or little known facts on the subject.

Communicativeness: Eye contact, smiling and friendliness in the form of body language will influence your communicativeness. Some people find that the arrangement of the classroom will enhance the communication atmosphere. If you have an opportunity to move the chairs, tables or desks, the following would be the most conducive to friendly one-way communication. Instead of a podium, use a table; place it so you can stand in front of it—between it and the class. A desk or podium is less desirable. When you are behind a podium or desk, you tend to lecture to the group rather than discuss with them. Place it to the side of the room so you will be standing with the class. If you can arrange the students' chairs or tables, try to form a u-shaped configuration. With large groups of one hundred or more, this may be difficult. Keep the open end of the U facing you. In this way you can walk into the audience. For a long lecture, utilize the physical space by moving around. Voice is not the only contributing agent to a boring lecture. Your posture and physical activity are also important. So, walk into the middle of the U when you want to share a particular crucial point, and then move back out when you want to get back to the main theme or to summarize. In this manner you will also force yourself into better eye contact and will encourage audience feedback and reaction.

Another factor in being communicative is how you develop a point, again, *with* the audience. Bring the listeners along with your thoughts by saying "Let's call these . . . . . ." rather than "These are . . . . . ." It helps when you use the term "let's." The listener has the feeling of inclusion in the development of the theme. Use "we," "you" and "us" statements, so the audience is aware of your recognition of them. It is a subtle point, but a valuable technique.

Vocal Expressiveness: Not much need be said about vocal expressiveness, except that it is a significant ingredient in an enthusiastic lecture. The inflections, pitch, rate and loudness with which you speak are critical. Sometimes a speaking voice will be naturally nasal or low and difficult to understand. Only by practice in projecting the voice can this be overcome.

SECTION II
IMPROVING LECTURE PRESENTATION FORMATS THROUGH STUDENT INTERACTION

Thomas E. Cyrs, Jr.

The lecture has been a time-honored vehicle for teaching students since the pre-Gutenberg era when books were a rarity. The instructor or master read a book and summarized the work of other authorities while the students copied down what was said. Embellishments, explanations and comments were made, depending on the background and scholarship of the master. Literal dialogue and interaction rarely took place.

Little has changed. Today the instructor still "talks to and at" the students, who must listen and absorb. It is still strongly believed that the source of truth and knowledge is found in the substance of the lecture. Millions of dollars spent on audiovisual equipment and tens of millions of dollars spent on exploring new and innovative approaches in secondary and post-secondary education have failed to alter this traditional technique. The most popular and widely used means for instruction is still the group-paced lecture. Given that the lecture method will probably continue for some time to come, what are some techniques which could be incorporated to improve its impact on learning?

The purpose of the lecture is the transmission of information. The students are passive observers and have little opportunity to pose questions. Lectures are generally rigid in format with a defined amount of subject matter to be 'covered' within the time allotment (usually 45-60 minutes). The student's role is to outguess the instructor and discriminate between relevant and irrelevant subject matter.

Some purposes of the lecture are the application of principles, demonstration of procedures and techniques, and the introduction of new concepts. Another function of the lecture is to motivate students. How many of your instructors motivated you? The ability to excite and motivate students during a lecture is not only a gift, it involves a lot of hard work. How many of us really work at the *motivational aspects* of our lectures? Walk through the corridors of your institution and randomly observe students during lectures. What messages do you think you will receive?

The lecture presumes that the student is attentive, motivated, has good listening skills, can discriminate between relevant and irrelevant subject matter, knows how to take notes, and has the proper prerequisite content and skills. How many instructors actually verify whether or not the students possess these prerequisite skills? Without these skills, the student will have difficulty in understanding the subject matter and the results will be reflected in test scores. Frequently, the problem is identified too late to help the student perform satisfactorily. Who is at fault when this happens? Whose responsibility is it to ensure that the student has these skills? Can the instructor take the position that it is his or her responsibility to provide the lecture and it is the responsibility of the student to absorb the information? The answers to these questions are directly related to how the instructor approaches the lecture.

An instructor's delivery is significantly improved by the interactive lecture technique, in which the general passivity of the students is supplanted by their active involvement during the lecture. An interactive lecture consists of:

Subject matter presentation format	plus	student response	=	interactive lecture

Several techniques can be employed during the interactive lecture, namely, *structured notes* and interactive *response sheets*. (See section on Learning Packages). Subject matter presentation format includes the statement of performance objectives for the specific lecture, organization and sequencing of the subject matter, a short test measuring the objectives, and the use of simple visuals, usually overhead projections or 35mm slides.[1] Student response includes a set of worksheets which contain a statement of the performance objectives, a rationale for the lecture, a set of interactive frames or structured notes, a self test and study questions which relate to a series of lectures.

Structured notes include a sequence of key concepts in the order in which they are presented and require the student to respond by filling in words, phrases, definitions or examples. The purpose of the structured note technique is to focus the attention of the student, require written response for further reference and provide overt clues as to what the instructor thinks will improve note-taking skills.

Unlike the structured notes, the *interactive response* sheets (see Figure 1) require the student to summarize concepts and apply principles, rules, concepts or ideas. This could take the form of written answers or the selection of correct answers from a list. This technique utilizes numbered frames (usually 4-6) on a sheet of paper. Frames could be left blank and problems presented on overheads or 35mm slides; problems could be included within the frame referred to during the lecture. Whichever method is used, all new terms and vocabulary should be included as part of the student worksheets. The structured notes or interactive response sheets could be collected after each lecture and reviewed for skill development as well as adequacy of the lecture presentation. Poor student performance could be the result of inadequate entry skills, but a class profile of poor performance may indicate the need to improve the lecture.

The subject matter presentation format is the heart of the lecture and is closely related to student response. The presentation of the performance objectives at the beginning of the lecture serves as an advance organizer for the students so that they know exactly what they will be expected *to do*. The preparation of the performance objectives to be presented will indicate the level of learning that the instructor desires to take place. If the purpose of the lecture is to transmit information only[2] then structured notes will probably suffice. If the student will be required to apply concepts and principles and solve problems, then the interactive response sheets would be preferable.

Specific contrasting examples are explained and a problem is presented which the student will solve within the appropriate frame on the response sheet. (See Figure 1). When presenting an interactive lecture, the instructor presents a new concept and clarifies all new terms. After presentation of the correct answer, clarifying questions from the students will indicate need for further elaboration during the lecture.

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[1]Cyrs, Thomas E. "Design Techniques for Interactive Media." *International Journal of Instructional Media*. Vol. 3(4), 1976, pp 297-302.
[2]Bloom, Benjamin S. "Thought Processes in Lectures and Discussions." *Journal of General Education*. Vol. 7, 1953, pp. 160-169.

FIGURE I

Instructor _____ *Course* _____

Date _____ *Lecture Title* _____

PERFORMANCE OBJECTIVES:

Exhibit 1

Exhibit 2

Exhibit 3

Exhibit 4

Exhibit 5

Exhibit 6

Interactive lectures can be audio taped during the live presentation. Since all frames are referred to by number, the tapes can be easily used for review by students or for direct instruction by any student who might have missed class. If desired, interactive lectures could be prepared directly on audio tape and used in lieu of live lectures for self-paced instruction.

The techniques reviewed in this paper will significantly improve the lecture delivery system. They will require more time and preparation than do traditional lectures, but student learning should improve significantly.

PROCEDURES FOR LECTURE PREPARATION AND PRESENTATION

1. *Select* concept/principle/procedure and relate to overall course
2. *Establish teaching* objective (What will *you* do to design your lecture?)
   a. inductive
   b. deductive
   c. mode of presentation -live and/or mediated
3. *Prepare lecture.*
   a. analyze content
   b. establish *learning* objectives (What will your students have to know after the lecture?)
   c. sequence learning objectives
   d. write body of lecture
      (1) define all terms and relate to the overall concept
      (2) draw analogies when appropriate
      (3) provide and explain concrete examples
      (4) apply concept
         (a) identify points of interaction for student written responses
         (b) specify problems and point of interaction (by frame number)
         (c) request student response
         (d) confirm correct response or range of responses
      (5) review, if appropriate
      (6) summarize
      (7) preview next lecture topic
      (8) identify points and places for media -either overhead projections or 35mm slides for large group presentation
         (a) review the body of the lecture script for:
            (1) ideas that could be visually reinforced
            (2) points for clarification
            (3) humor, particularly metaphor and hyperbole
            (4) action verbs and adverbs
            (5) problems to be presented
            (6) questions to be answered
            (7) need for image magnification
            (8) special effects
            (9) aesthetics
            (10) color requirements
4. *Prepare structured note outline and/or interactive response sheets*
   a. Lecture topic notes
   b. Date or presentation
   c. Lecture objectives

d. Prerequisite knowledge skills (from prior lectures or courses)
e. Rationale for lecture
f. New terminology and appropriate definitions to be introduced into the lecture
g. Write an outline for the structured notes
   (1) key concepts
   (2) points for summarization
   (3) examples to be copied
h. Produce and number frames and problems for interactive response sheets. (These could be points for mediation)
i. Summarize lectures
j. Write progress quizzes (self-administered and corrected)
k. Provide answers for the progress quiz
l. Suggest minimum score proficiency and action to be taken by the student if the score is below this level
m. Preview next lecture topic

5. *Prepare for presentation*
   a. Survey room if it is unfamiliar
      (1) locate electrical outlets to determine if an extension is necessary
      (2) determine if shades (if present) need to be drawn when 35mm slides are to be used
      (3) order audiovisual equipment
      (4) reproduce structured notes and/or interactive response sheets
6. *Present lecture*
   a. Audio tape lecture for review
      (1) review the performance objectives for the lecture
      (2) explain the concept(s) and subconcepts including definitions which will be necessary for comprehension
      (3) provide and explain examples
      (4) present problems to be completed on worksheets
      (5) confirm the correct response and elaborate on reasons
      (6) elicit questions for clarification
      (7) review steps 2-6 if too many students need further clarification (present alternative problems in step 4)
7. *Collect progress quizzes*
8. *Analyze results if student response is inadequate*
9. *Revise lecture within the context of student response*

These procedures might seem elaborate at first. However, they are logical and make for good planning. As you use the technique, your familiarity and experience will speed the process considerably.

DESIGNING EFFECTIVE VISUALS

Martin E. Finch

The old saying "one picture is worth a thousand words" applies to most written or spoken presentations. To illustrate is to make clear; to explain, as by figures and examples. These two statements while seeming rather obvious and pedestrian are a valuable guide to the educator when determining whether or not to illustrate a lecture or a written text. The "thousand words" adage implies economy, and the definition of "to illustrate" implies efficiency. By effectively illustrating your presentation you will gain both economy and efficiency.

In order to be efficient and economical, effective visuals must be clear. To be clear, they must be both readable and legible. LEGIBILITY refers to how visually discernable an object (the printed word for example) is to an audience of students. While legibility has an affect on readability in a visual sense, readability has to do with the past learning experience of the audience. By way of example, a very legible No Smoking sign would not be readable to non-English speaking people, even though the lettering is clear, large, and well illuminated. A sign with a graphic of a cigarette with an "X" through it could be both legible and readable to non-English speaking people. Readability implies a verbal element, whereas legibility involves the visual sense. While both are often used synonymously, we will confine our discussion here to the visual sense, and focus on legibility standards and criteria for designing visuals.

In order to develop legibility criteria and standards, we need to have a basic understanding of the characteristics of both printed and projected media. Firstly, we need to realize that in order to print or project a graphic (picture or drawing) it needs to be reproduced into another form. In the case of printing, a plate has to be made by a photomechanical process, and to make a projected graphic some type of photographic process must be involved. In both cases the original graphic is altered in some way, and a new reproduction is created. This reproduction is NEVER as legible as the original, and the degree to which it differs from the original can vary greatly depending on the legibility of the original, and the quality of the reproduction. If the reproduction is not legible, the graphic will not be readable, and there will be no information transfer in the process.

What are the differences between projected and printed graphics? The main difference is the environment in which they are used. A graphic printed in a book such as this can be scrutinized by the learner at his own pace, without any special equipment, and within whatever environment he chooses. A projected graphic (which we will refer to from now on as a slide) does not afford the learner the same freedom. He can see the graphic only with special equipment, in a specialized environment requiring electricity, a screen, and projector, and only at special and limited periods of time at the control of the lecturer or librarian. Since slides shown during a lecture are on the screen only so long as the lecturer wills them to be, they must communicate their contents more efficiently. Therefore, they need to be simpler and more direct than graphics for the printed page.

LEGIBILITY AND LETTERING

In our discussion of legibility standards and criteria for printed and projected graphics we will need to concern ourselves with the typography or the letter forms which are used, their size, thickness, and shape, and how they are spaced on the graphic. In order to discern which sizes of alphanumeric letter characters to select, it is helpful to discuss the most widely used measure of visual acuity, the Snellen Eye Chart (figure number I). Here eight sizes of "slab-serif" letters are arranged in descending size order on a wall chart. The viewer is asked to stand 20 feet from the chart and read down the chart until the letter size is

Figure 1

SNELLEN'S TEST TYPES
FEET
100
C T
100
D L
70
T C E O
50
X C V F
40
Z A O T H
30
F T E V L C
20
C L V F O T Z E
15
E A C F D L O T
10
D V C L A E O T F

illegible with each eye. In a survey of "Binocular Visual Acuity of Adults," the U.S. Public Health Service reported in 1962 that 90% of U.S. citizens between the ages of 25 and 75 had a natural or corrected visual capacity of 20/30 (i.e., they could read the line marked 20 with one eye and 30 with the other). Applying these findings to our legibility discussion, we can assume that 90% of our intended audience could read a 1/2" letter on a screen from 20 feet.

In order to facilitate your selection of letter size and letter thickness, I have taken the liberty of borrowing a chart from the "Leroy Lettering Equipment" catalogue published by Keuffel and Esser Co. 1970 (figure number 2a & b). The Leroy Lettering set is a widely used device for both professional and amateur chart and graph production which utilizes a pen with various pen size widths, a scriber, and a series of templates with letter heights from 0.04 inches up to 0.5 inches in standard sets, and as large as 2 inch height in specialty sets. The chart has the pen width size across the top and the template size in the vertical column, with their recommendations marked in asterisk. While there are many such devices for lettering, the Biomedical Graphics Department staff has been working with the Leroy set for many years, and in figure number 3a and b we have developed a chart which recommends the appropriate letter size and width for a small (3" x 4"), medium (4" x 8") and large (12" x 16") graph. A sample graph at bottom of the figure is prepared using these recommendations. This represents a method that has worked well for us over the years, but it is by no means definitive, and should be used only as a guide.

There are many other methods of lettering graphics with new ones being made commercially available every week. I will try here to summarize the various methods, and offer some general comments about them.

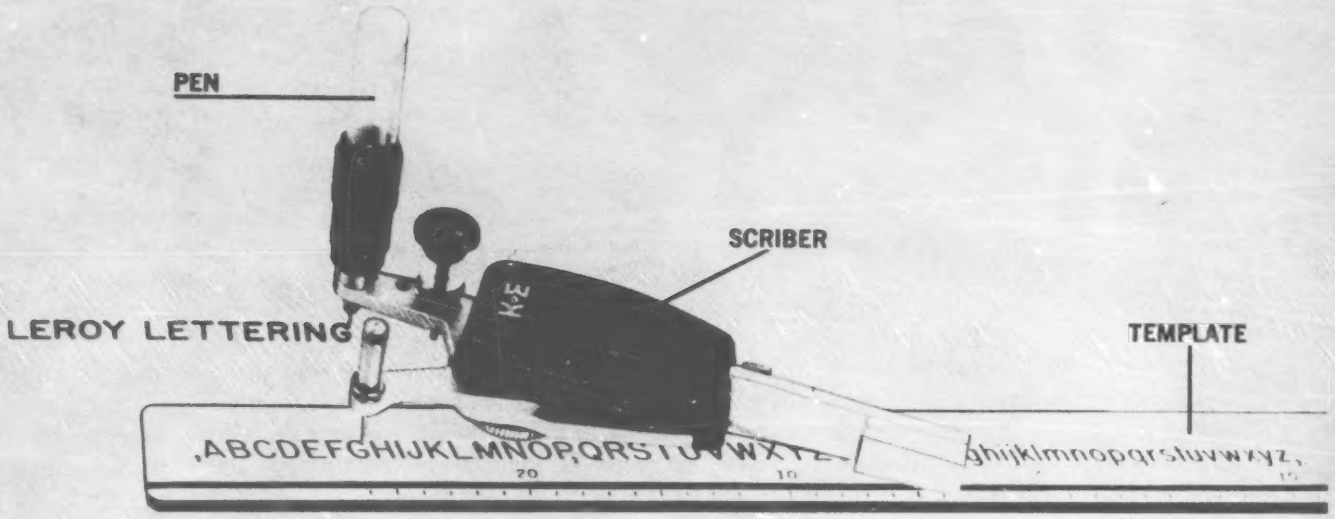
1. Hand lettering – obviously the cheapest and the fastest. However, be concerned about its legibility. Letter thickness and spacing are usually the biggest problem, along with the darkness and evenness of the individual letters.
2. Typewriter - also inexpensive and fast. Be careful to use a really black ribbon, and use a sheet of carbon paper behind original facing forward when typing. In this way the letter is struck both in front and behind the paper at the same time, producing a very dark letter. Use capital letters and underlining for emphasis *only*, with lower case letters for the body of information. Disadvantage of typing is that you can use only one size of letter. IBM Selectric lettering balls are good in lending variety (use italics, various letter styles helpful). Another disadvantage is that you cannot curve or slant the lettering as with other methods.
3. "Rub-off" style lettering – as pictured in figure number 4 is available at most art supply stores, costing between $3 to $5 per sheet depending on the brand, of which there are many. Here designer letters are merely rubbed off the back of a clear plastic sheet onto the surface of a graphic. They are easy to use, create professional looking graphics, but are expensive since once you use up all of a specific letter on the sheet it becomes obsolete.
4. Photomechanical lettering – there are numerous types of equipment that can produce letters by either photographic or mechanical or photomechanical processes. While these are valuable tools for professionals, their cost can be prohibitive for individual or amateur use and so they will not be described here.

In summary, there are many methods of lettering graphics. We have described a few here, with brief mention of their advantages and limitations. Regardless of which method of lettering you may choose to use, there are legibility standards and criteria that govern their effective use. Perhaps the most important of these is formatting.

FORMATTING GRAPHICS

The form or shape of the graphic should be directly related to the form or shape of the media in which it will be reproduced. Each media has its own size and shape restrictions, and knowing what they are will

Figure 2a & b



RECOMMENDED TEMPLATE & PEN COMBINATIONS IN ACTUAL SIZE

The chart shows the wide range of LEROY lettering effects that can be produced by combining various LEROY templates and pens.

• Indicates the combination of template and pen recommended for a good proportion between the thickness of stroke and the size of letter.

TEMPLATE SIZE	PEN SIZE 0000	000	00	0	1	2	3	4	5	6	7	8
40	A•											
50	A•											
60	A•	A	B	C								
80	A	A•	B	C								
100		A	A•	B	C	D						
120		A	B	C•	D	E						
140		A	B	C	D•	E	F					
175		A	B	C	D	E•	F	G				
200		A	B	C	D	E	F•	G	H			
240		A	B	C	D	E	F	G•	H			
290	0.29 inch		B	C	D	E	F	G	H•	K		
350	0.35 inch		B	C	D	E	F	G	H	K		
425	0.425 in		B	C	D	E	F	G	H	K	L	
500	0.50 inch Letter Height		B	C	D	E	F	G	H	K	L	M

Figure 3a & b

Template Size and Pen Weights for Components of a Simple Graph

Components	Size of Graph		
	*Small** 3" x 4"	*Medium** 4" x 8"	*Large** 12" x 16"
ORDINATE AND ABCISSA BOX	00-pen	0-pen	1-pen
ORDINATE AND ABCISSA NUMBERS	TEMPLATE — PEN WT. 200 — 00	240 — 0	290 — 1
ORDINATE AND ABCISSA LABELS	200 — 1	240 — 2	290 — 3
INSIDE LABELS	*200 — 00 Slant*	*240 — 0 Slant*	*290 — 1 Slant*
SUBTITLE	175 — 0 CAPS	200 — 1 CAPS	240 — 2 CAPS
TITLE	240 — 2	290 — 3	350 — 4

**Sizes given for small, medium and large graphs are approximate*

Sample Template and Pen Sizes
Title - Template 290, Pen 3
Graph Size - 6"x8"

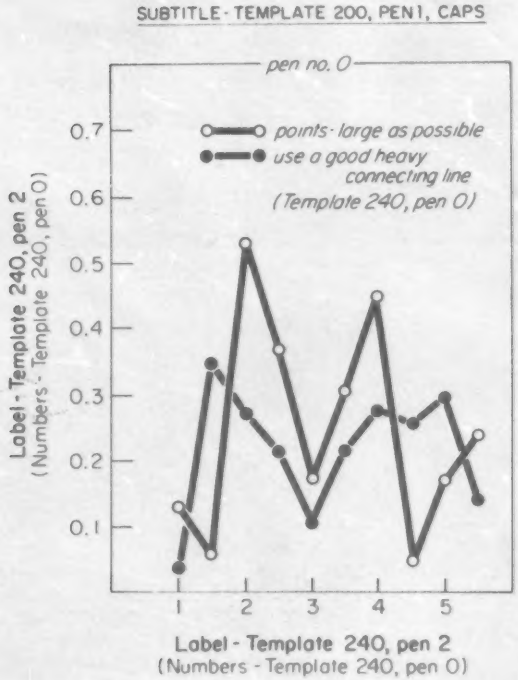


Figure 4

How to use Zipat

Alphabetical Index

(W) Indicates typeface is available in white.
(G) Indicates typeface is available in gold.

Style No	Typeface Name	Page No
	Sans Serif	
12	Announce Grotesque	9
100	Antique Olive Med	9
(W) 101	Antique Olive Bd	10
102	Antique Olive Compact	10
14	Avant Garde Extra Light	12
(W) 15	Avant Garde Medium	12
(W) 16	Avant Garde Demi Bold	13
(W) 17	Avant Garde Bold	13
533	Blippo Black	11
(W) 532	Blippo Bold	11
604	Bolt Bold	18
527		14
528	BUSORAMA MEDIUM	14
(W) 529	BUSORAMA BOLD	14
80	Churchward	14
535	Circulus	15
19	Eurostile med	19
20	Eurostile bold	19

Style No	Typeface N
(W) 37	Futura Me
38	Futura Me
(W) 39	Futura D
(W) 40	Futura E
(W) 42	Futura Bol
41	Futura E
45	Futura E
43	Futura D
77	Gill Sans
78	Gill San
79	Gill Sa
76	Gill U Outlin
48	Grotesque 7
(W) 46	Grotesqu
47	Grotesqu
49	Grotesq
(W) 50	Grotesq
107	Handel
(W) 53	Helvetic
54	Helvetica
(W) 55	Helvetic
(W) 57	Helveti

(Taken from 2 Ipatone Inc. Catalogue 1976)

help you design more effective visuals. To begin with, the most widely used projected media, the 35mm slide has a rectangular aperture of 35mm x 23mm, or an aspect ratio of 3:2. The 35mm slide can be designed in both horizontal or vertical formats, but the aspect ratio remains 3: 2 in either case. Since most projection screens are either square or horizontal, and because most other projection media (filmstrips, movies, and television) are limited to horizontal formats, I strongly recommend that when you have a choice, design *horizontal* format visuals. In doing so, you will minimize projection problems like head shadows on screen, and slides that fall off top and bottom of the screen. To avoid confusion of terms, a 2 x 2 slide has the same outer measurements as does the 35mm slide (i.e., 2 inches by 2 inches), it differs only in aperture size and shape. The 2 x 2 slide has a square format with an aperture size of 35mm x 35mm. This difference is readily observed in figure number 5.

When preparing graphics for other projected media, format is even more crucial. For example, when using 35mm slides on television, or in 16mm movies, the graphic information areas on the sides of the slide will be cut off as seen at the bottom of figure number 6 (taken from *Planning and Producing Slide Programs*, Eastman Kodak Pamphlet S-30, P. 39). When designing a graphic for any of these media you will find this chart very useful. At the top of figure number 6 are Kodak's recommended typewritten copy formats for a 1:1 ratio (2 x 2 slide), a 3:4 ratio (filmstrip), and a 2:3 ratio (35mm). Here they recommend the maximum number of typing spaces for each line. The simplest *rule of thumb* to use however is this: when you hold a 35mm slide up to ordinary roomlight, you should be able to read the type with your naked eye. If you can't, it probably won't be legible when it's projected in front of an audience. For those of you who desire more detailed information on this topic, this Eastman Kodak Pamphlet S-30 is an excellent resource.
We have seen here that formatting is one important aspect of designing effective graphics; another one of equal importance is reproducibility.

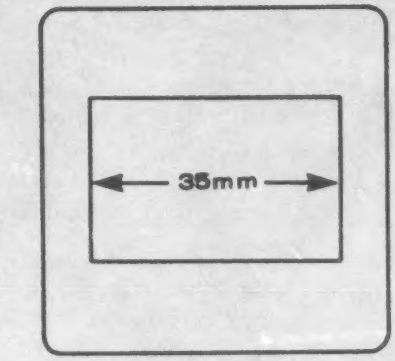
REPRODUCIBILITY OF GRAPHICS

As we discussed earlier, graphics are almost always reproduced in some other media form in order to reach large audiences, whether it be through print or by means of projection media or both. No matter how good the reproduction (or copy as we will refer to it) is, it will never be as legible as its original, i.e., something is lost in the process. A key principle in designing effective graphics is to minimize what is lost in the ultimate reproductive process. This is accomplished through an understanding of the transmission media, what its limitations are, and some basic techniques and materials to use in preparing graphics. While this is a wide ranging topic requiring a great deal of study and experience, a few suggestions may be of help to you.

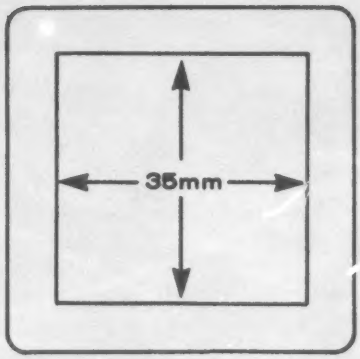
Let us first talk about the photographic process involved in making slides from graphics, or as we refer to it: Copy Photography. There are three main categories of film transparencies: Litho, Continuous Tone, and Color. Litho film is a high contrast black and white film which only records black or red images on the original. It does not see any other colors, and it does not see or record shades of gray. Its equivalent in printing is line reproduction. When preparing graphics for litho film, make sure to use black (india) ink on a very white paper; an intense red magic marker type pen can also work here. The continuous tone films such as Tri-X, Panatomic-X, etc. are analogous to the halftone process in printing. Here most shades of gray are seen and recorded on film. The blacks and whites are not as strong, and the overall contrast between black and white is less than in litho film. Subjects such as x-rays, portraits, chemical glassware reactions, are suitable subjects for continuous tone film. Color films such as Ektachrome, Kodachrome, etc. are used in an analogous way to the 4 color printing process. Here shades of gray as well as all colors are seen and recorded on film. Any film with the suffix *chrome* refers to color transparency, whereas the suffix *color* refers to a negative transparency. A common misconception is that you can make prints only from negative films. Today there are direct positive processes for printing both black and white and color.

Now that you know that there are three categories of slide making films you might be wondering when to use them. The simplest and least expensive one to use is litho, and it gives you the most variety. Let's say that you have planned to produce a series of typewritten charts in 35mm slide form. You have kept in mind the legibility and formatting standards and typed your originals using a very black ribbon with

Figure 5

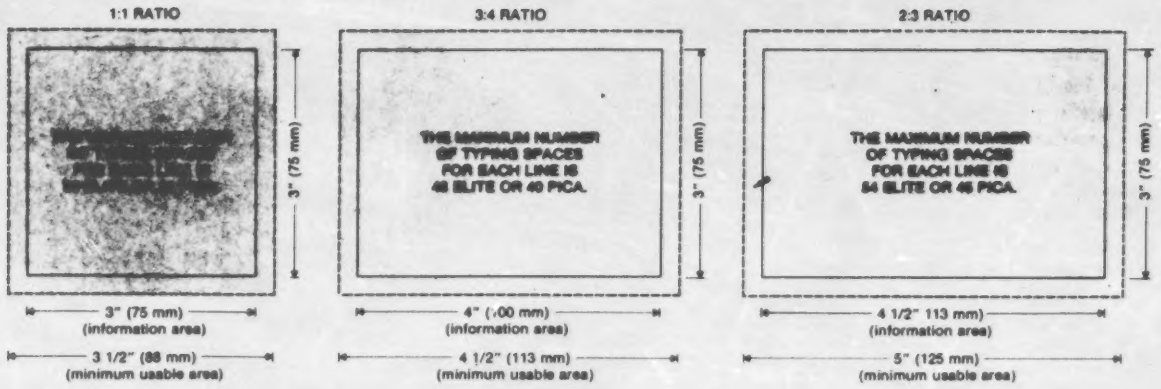


35mm

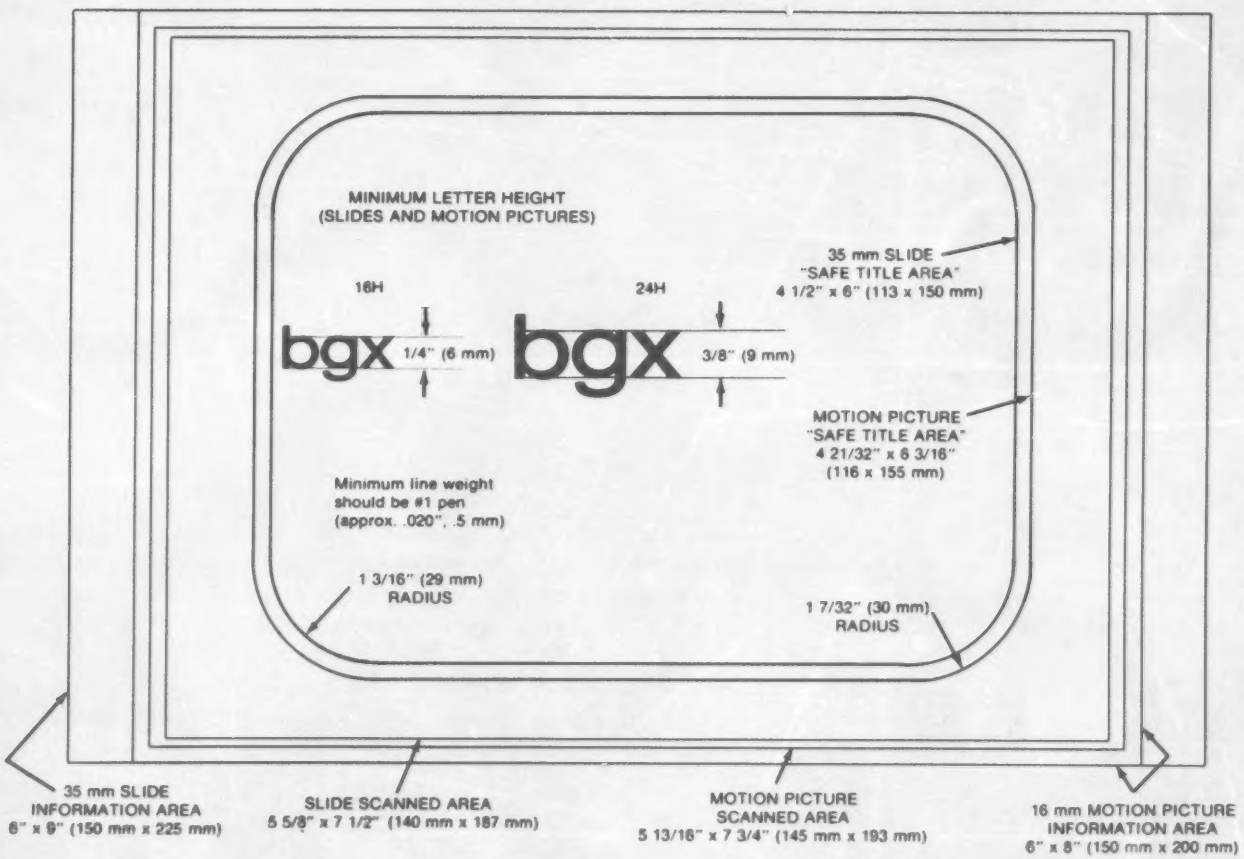


2x2

Figure 6



Maximum size of information area for typewritten copy.



Dimensions of artwork templates for materials used in the television system. This illustration, which was drawn to scale, can be photographically enlarged and used for artwork templates.

Taken from *Planning and Producing Slide Program*, Eastman Kodak Pamplet S-30, P. 39

carbon paper face up in back of the original (as described earlier), and you are now ready to have slides made for your lecture. From one original, you can make at least four different types of slides: a positive, negative, tinted negative, and ozalid. The positive slide looks exactly like your original (black letters against a white background). This can be made using direct positive film, or by using a negative film and positive print film. A negative slide is the exact opposite of the positive (white letters against a black background). This can be accomplished using a negative litho film. A tinted negative is nothing more than a negative which has been hand painted with transparent dyes in the clear areas. To do this, you will need a good quality artist sable brush (number 000 to number 1), and a set of Dr. Martin's Synchromatic Transparent Water Colors. You can selectively paint words or phrases in various colors for emphasis and aesthetics. The ozalid process produces a slide with a royal blue background and white letters from a litho negative.

One final area to discuss in this chapter is the design of visuals for publication in scientific journals and/or textbooks. As you may know, most journals have an Instruction To Authors page which is usually located on the inside front cover. Here instructions pertaining to manuscript form and style as well as submission of illustrations is provided. In some cases, failure to follow these instructions can result in delay of acceptance or rejection of your paper by the editors. Reading these instructions carefully before writing your paper is helpful, and if there are directions that are not clear to you, either consult a professional graphic designer, or contact the publisher for clarification. All of the legibility standards, which we have discussed earlier, apply to designing graphics for publication as well as slides. The following are a few random suggestions I have for improving your chances for acceptance by editors, and having a paper with effective visuals.

Whenever possible, create graphics with line reproduction in mind, i.e., pure black and white. These are the easiest and the cheapest to reproduce in print. Use very black lettering and lines on very white paper. Secondly, always send 3 glossy photographic prints 5 x 7 or 8 x 10 size, and the original art to the publisher with the manuscript. The 3 prints will be used for editorial purposes; the original should be used for making the engraving. Since most originals will be reduced in size when published, try to make your originals not much larger than 8 1/2 x 11 size; this also facilitates mailing. When lettering is reduced too much, spaces inside and between letters "plug-up", leaving an illegible blob of black; the same is true of lines too close together. Lines that are too fine, or letters that are too fine, do not hold up well when reduced; often they are unprintable.

SUMMARY

In this chapter, I have attempted to direct your attention to the importance of readability and legibility in designing graphics. We have talked about lettering styles and methods, formatting visuals for various media, described three types of film transparencies for making effective slides, and finally requirements for publication of graphics in journals and textbooks. While this chapter does not go into depth in any one area, it should provide you with a framework on which you can design and use more effective visuals in the classroom, learning center, and in your publications. If you need any more specific information on any of these topics, or require professional assistance in producing graphics, please do not hesitate to contact the author or any members of the staff of Biomedical Graphic Communications by calling 373-8824.

THE PERSONALIZED SYSTEM OF INSTRUCTION

James G. Henkel

Over the last 25 years, higher education has developed in such a way that educational opportunity has, at least in theory, become available to all members of society. Much of the emphasis and effort during this time was directed heavily toward assuring that the right to a good education is available to everyone. More recently, however, the emphasis has been shifting toward ways of assuring the maximization of learning for each person,[1] which is a significant step beyond just the *opportunity* for education. One result of this changing emphasis is a move toward the *individualization* of instruction and individualized learning. The efforts in this direction can and have taken many forms, including Programmed Instruction, Computer-Assisted Instruction, Individually Prescribed Instruction, and the Audio-Tutorial System. One new instructional system which has probably received more attention and use than any other is the *Personalized System of Instruction* (PSI), about which the present chapter is concerned. The early objectives of this chapter are to provide you with the knowledge of the characteristics of the PSI method and, briefly, the learning theory on which it is based. Following this, the remainder of the chapter is intended to provide, in some detail, a discussion of the advantages and disadvantages of the method, the logistics of implementation of the method, the problems often encountered in implementation, and some selected examples of its use in various disciplines. The intent of the chapter is to provide an easily referenced compilation of information about PSI which is useful to those who are interested in learning what it is and why it works, as well as to those who are considering implementation and need to know how to do it and what to expect.

CHARACTERISTICS: WHAT IS PSI?

If you were a student in a *typical* PSI environment, you would begin your study by obtaining a set of reading materials (perhaps a textbook or set of notes with references) in which the points or concepts to be learned are explicitly stated. These materials are divided into small, discrete units or *learning modules*. Included in each module is an extensive set of study questions which you may use to test your learning of the material in that unit. You would attend no lectures in the traditional sense, but you would be expected to study the first module until the stated objectives of that module are mastered, with time not usually being a major factor. When you had mastered the material, you would be able to answer the study questions correctly and achieve the objectives stated in the unit. At that point, you would report to a room or series of rooms in which the course testing is being held. Here you would request a short quiz on the particular module you had just studied. The quiz will typically take 15-20 minutes to complete, and contain about 10 questions. The questions may or may not be the same as those in the study guide, but all will be designed to test your mastery of the module's objectives. Upon completion of the quiz, you move to another area of the room where the quiz will be graded immediately by a proctor. The proctor is often a student who has previously completed the class with a high grade, and who has been selected on the basis of the ability to communicate, as well as on the basis of thorough knowledge of the class material. The proctor will quickly grade the quiz, marking each answer as correct or questionable. He or she will then discuss and clarify any questionable answers with you, to determine whether or not the answer you wrote down is based on a misinterpretation of the question. In this way, your score on the quiz will reflect as accurately as possible your true knowledge of the subject matter. The proctor serves a second equally important function. By identifying those areas in which your mastery is deficient, the proctor can clarify any misconceptions or problems which you may have. This provides immediate feedback and reinforcement, and allows you to best learn from your mistakes.

To pass the quiz and proceed to the next unit, you must demonstrate to the proctor that you really have mastered the material in the module. This is usually done by achieving a very high score on the quiz, typically 90% correct, or 9 out of 10 questions. If you fail to achieve a score of 90%, no penalty is imposed, however. Rather, you are simply asked to restudy those parts of the material which were unclear to you, and then retake a different (but equivalent) quiz on the same material. There is, in theory, no limit to the number of times you could be tested on a given module, but it would be unusual if you needed more than two or three attempts to master it, in light of the help you get from the proctor. Upon completion of the sequence of learning modules in this manner, you would be awarded a grade of A.

Clearly, there are great and fundamental differences between the PSI approach and the traditional lecture or "lockstep" approach, where the pace of learning is regulated primarily by the instructor. These differences are so fundamental that they actually reflect a complete inversion of the philosophy upon which traditional education is based. The differences can be elucidated by examining the five major characteristics of PSI, which have been stated repeatedly in the literature, originally by Keller[2,3] and subsequently by others.[4,5]

The two most fundamental characteristics of PSI are those of *mastery learning* and *flexible scheduling*. By adopting these two principles, the educational process is fundamentally changed. Mastery learning is based on the pedagogical concept that anything that is worth learning is worth learning thoroughly and completely, and that one unit of information must be learned to a high level of competency before a second unit based on the former one is attempted. By adopting the concept of mastery learning, the second fundamental change is naturally brought about, that of flexible scheduling. Since each person learns at an individualized optimal rate, if the breadth and depth of learning is held constant, the time one takes to achieve that learning must depend on his or her individual rate. This is in direct contrast to the "traditional" systems, where an amount of material is presented within a fixed time frame and the degree of learning is allowed to vary over a continuum. This variation is then reflected in the grade distribution at the end of the "traditional" learning sequence. It should be clear that both the degree of learning and the time frame in which it is learned cannot both be held constant.

It is this reversal of traditional thinking that accounts in large part for the increase in high grades which result in a PSI environment. This apparent inflation can be recognized as a logical conclusion resulting from the implementation of mastery learning. If, as Bloom asserts, 95 percent of any group of students can attain mastery of a given subject matter if given sufficient time and help, then 95 percent of the students should attain A grades. This is only true, of course, if an A is meant to certify that a student has mastered the objectives, rather than the fact that a particular score has been achieved.

A third essential component of almost all PSI applications is the *proctor*. The proctor is typically a student who has completed the sequence earlier, although, in some cases, a student currently enrolled in the sequence may be chosen. The function of the proctor is to serve as the primary point of contact between the students in the class and the instructor. It is the proctor's primary duty to grade the unit quizzes and discuss the results with the student, to guide each person toward mastery learning. While it is recognized that each proctor will have a different and individual teaching style, collectively they serve as the more or less directly-connected eyes and ears of the instructor, and as such, represent the major line of communication between the instructor and the students. In any well-functioning PSI application, the proctors are quite highly trained, not in the sense that they are all alike, but rather that they are all very competent in their ability to examine the student's answers for validity, as well as in their ability to communicate the relevant concepts effectively. They are, in this manner, acting as surrogate instructors for well defined components of the course material.

PSI can exist very nicely without proctors, but only in the environments where the total class size doesn't exceed a dozen students or so. With numbers beyond this, the demands of time placed on a single instructor cause the quality of the product to degrade rapidly. Because there are relatively few situations where class size can be limited to 12 or less, the use of proctors has become an essential component of most PSI applications. Indeed, without proctors the mastery learning and self-pacing criteria serve only to *individualize* education, not to *personalize* it. To personalize education, individual interaction with other people is a basic necessity.

The fourth component of PSI is also one which grows out of the previously discussed mastery and pacing criteria. Since each member of the class could in theory be working at a different point within the material, the lecture ceases to be a viable primary means of communication and information transfer. In its place is a much greater *reliance on the printed media,* at least historically speaking. This reliance certainly does not exclude the use of media-based nonprint resources and other teaching aids, but unless the objectives dictate their use, they are not essential to PSI, as are the printed media. Because the physical materials are so important to learning in PSI, much greater effort must be made to assure that the points to be learned are stated directly and unambiguously. If this isn't done, a much greater load will be placed on the proctors and instructor, who will end up giving individual "mini-lectures" to each student who doesn't understand the ambiguous point in the reading materials. Unless the text or other reading materials are specifically designed to be used in a PSI format, they will often be supplemented with extensive study guides, usually written by the instructor. These will contain (1) a concisely-stated summary of the important points of each chapter or unit; (2) a list of performance objectives which the student should have mastered upon completion of the unit; (3) explanatory material for sections of the text which may be unclear or directed toward a different audience; and (4) a series of study questions with which the student may self-test in preparation for the unit quizzes. These study questions have in many cases comprised much of the actual unit quiz.

The fifth and final component of the original PSI format is the *enrichment lecture.* We must be careful to differentiate this component from the more traditional lecture, where essential information is transferred. In PSI, lectures are often scheduled periodically to motivate students to keep up the pace, i.e., they serve as one of several antiprocrastination measures (*vide infra*). Often, only students who have progressed to a particular point are invited to attend. One use of this lecture may be to expand upon concepts recently studied in the course, or to treat some related area in greater depth. These lectures are always optional and should not contain any essential information not available in printed form. This fifth component is the only one of the basic criteria that is considered by many to be nonessential. While it was included in the original formulation of PSI,[2] it has also been omitted with no seeming harm to the environment.[7] Probably the strongest points to be made on behalf of the optional lecture is that (1) it facilitates communication to a large part of the class simultaneously, and (2) it allows the instructor to perform to a well-informed audience which wants both to listen and to learn the material presented.

To recapitulate at this point, one can see that if the basic elements of PSI are adopted, a fundamental change in educational philosophy invariably occurs. Instead of holding time constant and letting the degree of learning vary, the self-pacing feature holds the degree of learning constant and lets time vary. The mastery learning feature holds this degree of learning at a very high level, based upon the philosophy that if the material is worth learning, it is worth learning well. The mastery learning criterion interfaces well with many of the basic principles of competency-based education, since learning, especially professional learning, if often highly cumulative. If mastered early, other essential skills may then be learned in turn, building to the ultimate test of professional practice. Do not, however, equate mastery learning with competency-based education--they are not identical. Mastery learning may be used quite effectively in a competency-based learning environment, to help assure that the competency criteria are met, but mastery learning doesn't in itself make any statement about the validity of the concepts covered. Further discussion of competency-based education may be found elsewhere in this work.[8]

The combination of the above two features obviates the use of repeatable tests or quizzes, since the student must be free to make mistakes and learn from them by discussing poorly understood points with the instructor. Since these discussions and interactions take a significant amount of time, it becomes necessary to recruit help for the instructor if one desires to operate a PSI environment with more than a dozen students. This amplification of the instructor's efforts is at the heart of the third component, the use of proctors. Finally, if the material is to be learned completely and precisely, it must be stated and interpreted correctly by each individual student, at the time of his or her choosing. For this condition to hold, the material must be in printed format, so that all information is within a self-contained package. Thus, the reliance on printed media, component 4. The use of optional lectures, component 5, seems to be of lesser importance to the educational effectiveness of the system.[7]

I have attempted, to this point, to introduce the characteristics of PSI, and to illustrate how each of the four major components is related to the other three. It is precisely the close interrelationship between the components that has caused and does cause problems and failures when only some of the components are adopted. There are many examples in the literature of instances where partial implementation of PSI has failed,[9] often in part because the above relationships were not fully understood by those who implemented it.

THE THEORY OF PSI: WHY DOES IT WORK?

The Personalized System of Instruction has deep roots in learning theory,[10] and, thus, in psychological research. In fact, its theoretical basis is perhaps more solid than other instructional strategy. Before examining the relationship of PSI and learning theory, a brief review, perhaps somewhat oversimplified, will be presented.[11]

In the most basic sense, when an organism experiences learning, several characteristics are associated with it. For one, learning results in some *observable change in behavior* in the organism. This may be as simple as pressing a bar for food or as complex as explaining a complex theory when asked. Secondly, learning comes about as a *result of practice*. This criterion eliminates instinctive behavior from consideration as something learned. A third characteristic of learning is that it results in a *relatively permanent change in behavior*. An excellent example of this criterion is the fact that once the skill of bicycle riding or ice skating is learned, it is never forgotten (although a little additional practice may be necessary after an extended period). The fourth characteristic of learning is that it is not directly observable itself. What is observable is a change in behavior or performance before learning and after learning. In fact, it is exactly this lack of observability of learning that makes it so hard to measure and quantitate.

When one studies learning, one normally applies some *stimulus* (such as questions, problems, exercises, or experiments) to a person, the results of which can be measured. This may be a simple tone or color of light, or it may be a complex social experience. The outcome of the application of the stimulus is a *response* (perhaps written, spoken, or in some way produced) by the person, or if very complicated, it may be called an *act*. To measure learning, the response must ideally be measurable both qualitatively and quantitatively.

The type of learning on which PSI is based is known as *operant conditioning*, first studied by psychologist B.F. Skinner. The basis for operant conditioning is that when something or someone responds in a particular way to a stimulus, that response is rewarded in some manner. The person derives some pleasure from the reward, and will tend to repeat the rewarded or reinforced response to the stimulus. By measuring responses before and after exposure to a learning situation, the results of learning may be observed. This presentation applies most readily to simple learning situations, mostly with animals. When applied to humans, particularly those involved in higher education, the above model is seriously inadequate and overly simplistic, but it does serve as a basis for further study. The principles of behavior which form the basis for PSI may be stated in the context of the above material.

For anyone, a particular behavior is learned or strengthened through reinforcement or reward for that behavior. If a particular answer to a question brings a reward, such as a good grade, pleasure, recognition, or praise, the particular question-answer combination is thus learned or strengthened in the mind of the subject. Similarly, behavior which is already learned may be weakened by withholding reinforcement from the subject. This process is called extinction. Behavior which has been learned may also be extinguished or weakened by *punishment*, in which case fear may be evoked and the subject will do whatever is possible to avoid or escape the situation. In human terms, factors which cause such behavior include failing grades and the subtle public ridicule which one encounters when such a grade is posted. The low self-esteem or self-image resulting from failure also serves as a negative motivational factor in learning.

If one behavior is strengthened and another is weakened in a person, *discrimination* has been introduced. In this way, a person may be trained to proceed in one manner of action and avoid another. Along with the stimuli which are reinforced or extinguished, other stimuli which are present during these experiences may

themselves be reinforced or extinguished. These are called *secondary reinforcers or secondary aversive stimulators.* Examples of these may include a song played during a pleasurable experience, or the sound of a dentist's drill. In terms of human learning, there are several known *generalized reinforcers,* since they strengthen behavior regardless of the stimulus being applied. These reinforcers include actions such as attention, approval, affection, and submissive behavior. When a person is rewarded with one of these, whatever behavior one was showing in connection with it will be strengthened. One might consider token rewards such as money, high grades, time off, or optional class attendance as generalized reinforcers as well, since these accomplish the same end result of strengthening behavior.

The final behavioral principle to be considered is that of *shaping*, which is simply an extrapolation of the above principles, where behavior is modified by small changes in stimuli and rewards, rather than the introduction of radical changes in the learning environment. Shaping is typically what takes place in a programmed instruction situation, where the student's behavior or performance is changed a little bit at a time as each frame is covered. Taken together, these principles make up a technique called *contingency management,* where the rewards are given for positive appropriate responses and withheld for unsuitable responses.

PSI addresses these behavioral principles by attempting to maximize the rewards which produce educational behavior, minimize extinction and frustration, and eliminate fear and punishment (as evidenced in non-achievement and poor grades) from one's educational activities. It makes use of as many generalized reinforcers as possible and utilizes the concepts of shaping to a high degree. In the PSI learning situation, a student is offered the material to be learned in small portions which, when learned, are immediately reinforced by praise, encouragement, and a good grade on that unit. The specific facts to be learned are carefully stated and the tests are carefully constructed to minimize the possibility of frustration or extinction resulting from the study of the wrong material, and the tests are made repeatable with no penalty for failure, to minimize the negative effects of punishment and fear. Any learning situation should address the three basic items of (1) an effective stimulus (text, study guide, objectives, etc.), (2) a suitable high response possibility (the opportunity to answer or perform) and (3) a rapid and appropriate reinforcement of the correct behavior (a good grade for good work, approval, encouragement). Only PSI has all three of these items. The usual lectures, demonstrations, and discussion groups all have elements of the above, but all are deficient in at least one. This is not to say that learning doesn't occur in the traditional learning situations; rather, that PSI is the only system which has consciously been directed toward the inclusion of all three items in an attempt to maximize learning.

An added feature of PSI is the reinforcement given to the proctors and even the instructor. The proctor, when grading a quiz, receives the close attention of a student who is informed, motivated at that moment, and quite willing to learn. Since most students pass the quizzes on the first attempt (typically 85-97% do so, and, even for the most difficult units, at least 70% of them pass on the initial attempt[7]), the proctor receives a great deal of reinforcement by sharing in the success of the students, and measures his or her success by the students' enthusiasm for the material. These elements seem to be equally important to the more tangible rewards of academic credit or money given for the proctor's services. Experiencing some component of the "joys of teaching" is a very powerful motivating force, and an important one.

PSI: IS IT BETTER, OR JUST DIFFERENT?

Having now obtained an idea of what PSI is and is not, attention can be focused upon the most fundamental question concerning PSI--is it better than the traditional methods? This value judgement is a complex one, and in the past, instructors who considered using PSI often did so based upon evidence which was, for a large part, not fully substantiated or documented. The great majority of reports during the first few years of PSI use were authored not by educational researchers, but by practicing teachers who were more concerned with the quality of the educational product than the investigation of PSI per se.

As the use of PSI grew, more reliable, well-controlled studies have been reported. We now have a large enough research base to begin to make valid judgements on the use of PSI and to begin to answer the question, is it better?

The judgement of PSI has, in reality, two component parts which can be treated independently. The first of the two parts is an *attitudinal* part which reflects the students' opinions and impressions of the method, while the second part (but not necessarily second in importance) is the part which attempts to compare *actual learning* in the two environments. We will briefly look at some reported results for each of these components. Ever since its inception, PSI has produced a significant positive increase in the attitudes of students, when compared to a traditional lecture format. These attitudes are most often measured by student responses to questionnaires of varying formats. For example, in several studies,[12] students have been asked to rate a PSI class by comparing it to their experiences in a typical lecture class. The results of these uncontrolled studies uniformly show that a large majority of the students (from 59% to 100%) prefer PSI. In more controlled studies, where two or more parallel sections of the same course were used, very similar results were obtained.[12] In one introductory psychology course,[13] the ratings of the PSI section were higher than three lecture sections at the P=0.999 level of significance. Even when an open-ended survey was done, where students were simply asked for comments, reports of 96-98% favorable are not uncommon.[14] Clearly, the greater popularity of PSI among students is established beyond question.

The question of whether students learn more under PSI is a more difficult and controversial one, and one which has received a great deal of attention. The most significant difference in the two questions lies in the nature of each of the questions themselves. For the attitudinal evaluation, the answer being sought is one which accurately describes a collective state of mind, and is found by simply asking the students' opinions--problems of measurement of opinions are minimal. The measurement of learning, however, is far from trivial, and many persons have devoted entire careers to the pursuit of effective ways of scientifically evaluating it in a more controlled manner.

Many of the strategies one might think of to evaluate comparative learning between the systems become invalid when studied in greater depth. For example, the comparison of final letter grades or collective grade point averages is completely invalid, for the following reason. In the original PSI method, course credit was usually determined by quantity, i.e., by the number of units covered, since the quality component was built in by the mastery requirement. In a traditional course, the credit was based on the quality of a limited number of measurements, i.e., the midterm tests and the final. This difference in grade base produces complete confounding of the results, and claims of greater learning in PSI based upon the fact that more A's are given are completely without scientific basis.

Another common area of comparison between PSI and lecture content learning is that of examination scores. This method can be a valid one, if the respective environments can be properly controlled, and if both techniques address exactly the same cognitive objectives. This is not as easy to do as one might imagine. To meaningfully discuss content learning differences, at least six sources of confounding must be controlled.[15] These include differences in student population, differences in instructors, discrepancies in course materials and resources, the grading criteria mentioned above, differences in testing formats, and differences in student expectations about the course. In addition, some effort must be expended to insure that both of the test results to be examined accurately measure the same learning objectives in each system. Some of the above variables may be easily controlled by randomization and careful administration of instruction, while others such as student expectations and testing formats are more difficult to control. While many previous studies have failed to carefully control these variables, more recently a greater degree of experimental rigor has been applied. On the basis of several recent studies,[12,15] it can be said, at least at the introductory science level, that PSI produces at least as much content learning as the lecture method, and it often produces more. Moreover, there is some evidence which supports the observation that the material is learned more thoroughly, as measured by greater long-term retention of the material.[16] It might be that the greatest "payoff" is student attitudes, i.e., self-image, acceptance of responsibility.

Thus, there seems to be a growing body of scientific evidence that serves to confirm what PSI zealots have been saying for years, that PSI produces learning at least at the same level as the lecture method, and often

cognitively exceeds it. In addition, there is little doubt that students, by and large, rate it higher attitudinally, i.e., they enjoy it more. Considering both of these factors, PSI is an educationally viable alternative to traditional lecture format, when it is feasible to properly implement. One can now adopt it with a growing assurance that one's students will not receive a lesser education due to its use.

One concern which is often expressed and which hasn't as yet received enough attention is the question of PSI's application to skills at a higher level than recognition and recall, that is, the intellectual skills of analysis, problem solving, and creativity. Such skills have yet to be reliably measured in a PSI environment. The reports which address this question [5,17] are far from conclusive, but seem to report that PSI is at least as effective as the more traditional methods for teaching these higher level skills. In fact, one response to this criticism points out that the topic is not a new one, and the same question is a fair one to ask of the traditional format as well. To use Cross's words, "Until we have some better measures of creativity and problem-solving ability, we cannot say what *any* form of education does or does not do to develop these skills.[18] Upon examination of the evidence, it seems that PSI is no more deficient in this respect than any other method.

ADVANTAGES AND DISADVANTAGES: IS IT WORTH IT?

The question of whether or not PSI is worth implementing is a value judgement left to each faculty member. While a successful PSI course will benefit immeasurably from a benevolent, supportive administration, the motivation and desire to take the step into PSI must come from the individual faculty member. No administrator or committee can decree that a course or curriculum will be taught in the PSI format and expect it to succeed. To provide a basis for judgement, a compilation of the reported or perceived advantages and disadvantages of the approach will be presented here, along with brief commentary on each point.

As might be expected for a system which has received such widespread use, the reported advantages are far more numerous than the disadvantages. One of the major reported advantages is mentioned above, the fact that most students enjoy learning more under PSI than under the traditional lecture system. In several studies the most popular feature of PSI is the self-pacing feature.[14,19,20] Other features highly ranked by students include the personal interaction with proctors and the instructor, as well as the stepwise nature of the material.[19] A more positive student attitude is a definite advantage in learning, for when one is enjoying a particular activity, it is far easier to do well at it. The personal interaction component offers a distinct and somewhat rare opportunity to both the student and the instructor for a high degree of individual attention. If the instructor and proctors are perceptive, potential problems may be detected early enough to correct them before a student becomes confused or frustrated. Other benefits of this personal interaction may include a sharpening of communication skills and a gain in the students' ability to relate to others, as well as a possible increase in verbalization skills. These are admittedly intangible objectives, and few studies have reported PSI's applicability to this process,[21] but their potential usefulness in the clinical environment is obviously very high.

One distinct advantage which results from the repeatable test feature of PSI is that the student now has the freedom to be wrong and truly learn from previous mistakes. In a traditional format, the mistakes a student makes are often not resolved, but simply counted wrong. One will not usually respond with a complete answer to a test item if one isn't absolutely sure of its correctness, due to fear of the response being counted wrong. One common testing strategy followed by the student is to include only enough information in the stated answer to receive maximum credit, without risking penalty for demonstrating only partial understanding of the material. Serious misunderstanding of the material can occur on the student's part, and be undetected by the instructor unless the student volunteers the fact that it exists. In PSI, with no fear of failure and rewards for success rather than penalties for failure, a more open and fertile learning environment is established, where often a student will take a test without being absolutely clear on every point. In this way, the mistakes, having been discussed, serve as a positive learning experience for the student.[22]

There is also some evidence that PSI enhances generalization in learning compared to traditional format, that is, it enhances one's ability to apply the facts and principles learned in one area to some related area. It has been found that PSI learning seems to some degree to be superior to traditional instruction in the context of the spread of the effects from specific questions to more general ones on the same subject,[23] and also in the context of application of the learned material to areas where no training has been provided.[24] Several other reports indicate similar findings, with varying degrees of rigor.[25,26] This is an especially interesting point, since the converse of this is often heard, along with its companion criticism, that of PSI's supposed inferiority for the instruction of higher level skills, mentioned above. A second related point, one that is somewhat speculative and anecdotal, is that the manner in which students study in a PSI environment may be expected to increase their ability to learn independently. This is based also upon the print-oriented nature of the material. By developing good study habits, which PSI encourages, and learning to quickly recognize and extract the important points contained in written material, one may be more successful in terms of continuing education and the promotion of lifelong learning. This point has not been investigated to any degree, but has been mentioned by students in response to attitudinal surveys.[7]

Other advantages of PSI include the fact that a well administered PSI class is much more highly organized and well thought out. Since the material is print-oriented, the instructor must plan the entire sequence of instruction carefully and in advance of the actual administration of the course. It isn't possible to prepare the material the day before, as is often done in lecture courses. This advance preparation tends to add a stabilizing and organizing element to the material which the students often perceive and appreciate.[22] An additional benefit from PSI is the thorough training received by the student proctors. While these people have shown their mastery of the subject by performing very well in a previous course, they invariably report that they gain a very high degree of insight into both the immediate course material and the material present in their other courses.[22]

No new method such as PSI exists without some disadvantages, and it is important to consider these in at least as much depth as the advantages, to obtain a realistic picture of the method. One major disadvantage widely reported by both instructors and students is the fact that the method demands a significantly greater amount of time from everyone concerned. On the part of the instructor, time must be spent preparing the performance objectives and study guides, carefully keying each to the text materials if they exist, and attending the majority of the testing sessions during which he or she consults with students who have questions, grades tests, and mediates disputes in proctor grading. The instructor must also assure that the proctors are highly skilled in their mastery of the material and in their ability to relate the important points to the student. It is the instructor's responsibility to write and revise the unit tests, maintain the grading system (although the physical administration of the grades and tests may be handled by clerical personnel), and assign final course grades. To perform all of these functions well requires a commitment of time not experienced in a traditional setting.

On the other hand, the amount of time a student devotes to a PSI course is nearly always significantly greater than that devoted to a lecture course, thus raising the potential for overloading, particularly if more than one sequence is in PSI format. Studies have indicated that a student will spend 20-50 percent more study time per week on a PSI course.[27,28] Similar results have been found in a PSI-based pharmacy course, where sometimes 30-50 percent of the students' total weekly study time was devoted to the one PSI course.[7] Some would argue that a rigorous course of study is not a disadvantage, and there is undoubtedly some merit to this, but the limits of time which can be demanded should be carefully evaluated, if possible.

A second major disadvantage of PSI is the great potential for procrastination, which arises from the self-pacing component. This problem has been reported and studied at length, and seems to originate in human nature. If one is pressed by two tasks to be accomplished and one of these must be completed immediately, while the other can be put off until one gets to it, there is little doubt which task will be chosen. This tactic is not undesirable, as long as the second task is then addressed upon completion of the first. In many cases, however, the second task never is picked up again, since another demanding item may have come along. In addition to this situation, which happens frequently in a normal college curriculum, there are a number of students who just don't have the emotional maturity to totally direct

their own academic progress without close direction. This may arise from a lack of experience in doing so, or from other internal sources. The net result is the same, however: several students become discouraged and withdraw from the course, or are just never seen again. A great deal of effort has been devoted to finding suitable solutions to this problem which don't inhibit or permute the PSI environment, and specific suggestions will be discussed in a later section.

A third disadvantage of PSI, at least as perceived by some, is its public nature. Since all of the detailed objectives, study guides, course policies, and other materials are public documents, one's teaching activities and strategies are effectively laid bare before colleagues and students. While this may be more beneficial than harmful (since an instructor facing this will make sure that a quality product is generated), those accustomed to having ultimate autonomy and absence of public scrutiny in their courses may be threatened to some degree. In a related point, those who use the lecture as a component of ego-gratification (and nearly everyone does to some extent) may find that this element is missing under PSI, for the role of the instructor is significantly changed. Rather than playing the role of Actor and Dispenser of Knowledge, the instructor becomes a Manager or Facilitator of Knowledge, whose efforts are more directed toward helping students to learn rather than pouring information into their heads.

Thus, there are significant advantages and disadvantages to PSI, just as there are for any other method of instruction. Taken together, PSI offers an alternative to traditional instruction, and it attempts to correct many of the disadvantages of the lecture format, such as its failure to recognize individuality and its lack of success in the dissemination of information. In the process, it generates some criticism and disadvantages of its own, including a greater effort and time commitment and some increased problems of management. Many of the other criticisms discussed earlier have resulted from the fact that until recently, little hard evidence of the superiority of PSI has existed. This information is now beginning to appear, in scientifically valid form. One should keep in mind, however, that PSI is only about 10 years old, and like a ten-year-old child, one can see a potential, but can't predict what the child will accomplish during the next 20 or 40 years.

LOGISTICS OF PSI: HOW TO DO IT

There are three separate logistical categories with which one must be concerned when implementing a PSI environment, the areas of (1) instructional materials (usually printed), (2) test materials, and (3) administration. All of these areas must be considered in order to effectively build and maintain a PSI environment. In this section, it will be assumed that the previous material has been covered, and the reader is now interested in the details of beginning a course which utilizes PSI.

By way of preface, there is a basic axiom from which one should not deviate or strike a compromise during the first attempt at PSI. This axiom is based on the fact that the details of the method have been carefully worked out to approach the ideal PSI environment, blending the early vintage five points with other innovations to produce a high degree of balance. *Don't deviate from it,* at least initially. If it becomes apparent that you will be forced to make extensive changes in the plan, consider postponing your efforts until the climate is more favorable. There are many dozens of variations on the theme of PSI (these are often referred to as SLI — Something Like It), most of which succeed to one degree or another. They aren't, however, PSI. As you learn the details and gain experience, you will learn to anticipate the effects of "tuning the system" on the educational environment.

Instructional Materials. The first logistical category concerns the instructional materials. As mentioned earlier, the materials are historically print-oriented, although other media may be used if appropriate. The material is divided into learning modules or units, which may be keyed to a textbook or be self-contained. The format of these units may vary somewhat, but each unit should be composed of 5 essential components: (1) an introduction, (2) a list of objectives, (3) the explanatory text, (4) a study guide, and (5) answers to selected problems. The introductory material may be in any style, but it should set the limits and tone of study for the student. It may outline the goals of the unit and place the material in the perspective of the entire course. It is a particular advantage if it is interesting

reading which will peak the student's interest.

The list of unit performance objectives should be stated in terms which can be measured.[29] Its purpose is to inform the student of what must be mastered and what types of performance must be shown to successfully complete the unit. It is important to be as specific as possible, and to be precise in the the course demands. Avoid repetition of the impersonal phrase, "the student should. . . .," which tends to depersonalize the material.

The explanatory material may be a self-contained handout prepared by the instructor, but more likely it will be a chapter in a textbook or other commercially prepared source. If a text is used, it will not usually be directed specifically enough to the performance objectives and supplementary material must usually be provided by the instructor. This may take the form of a handout which corrects statements made in the book, expands upon them, redirects the emphasis of a passage, adds relevance to the coverage given to a concept, or provides more examples and applications.

The study guide is an important component of the learning module, for it is through its use that most learning takes place. The study guide may consist of many types of questions, from simple definitions to complex problems and essay-type items, and in general the more there are, the better. The students should be told that the study guides are for their benefit, and that they don't have to work more than is necessary to master the concepts. The questions in the study guide should be directed to the performance objectives, and should be at a similar cognitive level and style to the items the student is likely to find on a unit quiz. Above all, don't put new or surprise items on the unit quizzes. If it is an important concept or type of question that you want the student to know, put several items like it, or ones which address it, in the study guide. Many of the questions which appear in the study guide may also appear in unit quizzes, but the quizzes should not be limited to the study guides. It is even possible to include sample tests (self-tests) within or following the study guide, to aid the learning process. Above all, the study guide should be effective at training the student to perform the objectives stated at the outset.

The literature contains many examples attesting to the importance of the study guide. Both Miles, et.al.,[30] and Santogrossi and Colussy[31] have reported very significant gains in posttest scores when study guides are present, compared to when they aren't. There are also results[32] which suggest that the more study questions there are, the more generalization is likely to occur over all test items on a subject.

The fifth component of the learning unit is a listing of the answers to selected problems. These may be included within the textbook or handout, or posted in a convenient place. It is important that the student have access to answers to problems to determine if he or she has mastered the technique of problem solving. Since students in a PSI sequence often work alone,[7] having numerical answers is more useful than in a traditional setting.

In terms of management, the package represented by the learning unit, if properly designed, will never leave the student wondering what to do next. If one leaves a student wondering what to do next, he or she will do something else.

Unit Size. The size of each unit of instructional material is very important in determining the success of the method. For optimal operation, the material in each unit should represent about one week's work for the student. The temptation of many beginners to the method is to either make the content of the units too great, or to include too many units in the course sequence, or both. Perhaps this arises from a lack of appreciation of the difficulty of the material on the part of the instructor, or from the infectious zeal one experiences when it is realized how effective the method is. In any case, resist the temptation to add more material to the course. In fact, it is best to base a PSI course on less material, perhaps 80% of that covered in a corresponding lecture course. Remember that each student will be learning the material to a much higher degree, which takes more effort, and if they are asked to work harder, they shouldn't also be asked to do more than they did before.

The length of a particular unit may vary considerably, depending on its difficulty. In many cases, one textbook chapter, with associated objectives and study guides, will form a unit. In other cases, however, one chapter may be too long or difficult, and will have to be divided into two or more units. One rule of thumb which can be used to judge the length of each unit is that the test for the unit should take 15-20 minutes to complete, and it should test each objective in the unit. If these two conditions can't be met, the unit may be too long. A second way of recognizing an inordinately long unit, usually after the fact,

is the degree of procrastination seen among students working on that unit. While procrastination is a perpetual problem, if one particular unit is plagued by it, consider the possibility that its length may be too great. Recent research seems to support the greater effectiveness of small units. O'Neil, et. al.[33] have found an inverse relationship between unit size and the students' performance on unit quizzes. They also noted a tendency for students to procrastinate and to wait longer before beginning the next unit, as the unit length increased. Similarly, Semb[34] found a gain of 10-20 points on a 100-point scale in cumulative test scores when a section of course material was covered in four smaller units instead of one larger one. From personal experience in the Health Sciences,[7] it is difficult to place more than 8-10 objectives in one unit and yet keep it to a manageable length. Whether the material is typed (double space) or printed in a text, units greater than 20-30 pages in length become less effective learning units. Research results also tend to support this observation.[35]

The question of the ideal number of units in a course sequence is also somewhat difficult to answer, for the optimal number will depend upon factors such as the difficulty of each and the testing time available. For one 10-week quarter of instruction, most students can complete 8-10 units. In a 15-week semester, a collection of 14 to 18 units seems to be acceptable. In determining the number of units for a course, one should keep in mind that it is better to err in favor of too many small ones rather than too few large ones. Of course, the more units in the course, the more demands are put on the system regarding testing hours and proctor availability.

The sequence of the units also can be important to the success of the course, for the following reason. Most students will be encountering PSI for the first time, and will be somewhat apprehensive at the start. If the first unit or two is short and readily completed, the anxiety the student experiences will be dispelled and self-confidence will be built in his or her ability to complete the remaining units. This psychological management technique is a very effective one in terms of overall success in the course, and is certainly worth implementing.

The overall pedagogical sequence of the learning units is also important. If the students can see the logical development of the material occurring, it becomes much easier to complete the sequence.[22] One common organizational strategy in PSI is to base the student's grade in the course on the number of units completed. If this method is chosen, it then becomes very important to arrange the sequence of units so that all essential material is included in the group of units which must be completed for a passing grade in the course. Those units beyond the minimum criterion should not be essential units. If all units are deemed essential to the course, then some alternative form of grading should be devised by the instructor.

The presence of review units in the PSI sequence is one contingency management technique which holds a great deal of potential for improved learning. We have found it advantageous to build cumulative review units into the sequence at intervals of 4-6 units. Their presence serves to integrate the factual material and concepts presented in the earlier units, and offers the opportunity to address higher taxonomic skills[36] than can be addressed within each unit. The review unit is the ideal place to simulate complex situations which go beyond simple recognition or recall, ones which require synthetic or analytical skills. If the instructor chooses to do this, one may have to change the grading emphasis on the review units to a pass/retake basis, since the students will be asked to perform at levels not necessarily required of them in the other units. If the review tests are taken directly from the individual units at the same taxonomic level, they can then reemphasize the most important points of the earlier units. There is some valid evidence that the presence of review units in a PSI sequence does produce higher scores on posttests or comprehensive tests such as a final exam. Semb, et. al.[37] have observed a 5-6% higher average on posttest scores for sequences where review units are present, over sequences where they are not. Similarly, Davis [38] found that review units were effective at increasing learning, but only if a final exam did not form the basis for the course grade. Presumably, the awareness of an impending comprehensive test was sufficiently motivating to students to cause the integration of the material to occur without review units.

Test Materials. The second major category in which logistical considerations are important is the preparation of the testing materials. Little difficulty will be experienced in this area if one keeps in mind the purposes which the tests serve. Their primary purpose is to measure the degree of mastery the student has attained over the unit material. Because the attainment of mastery is so important, substantial effort

should be made to prepare several equivalent tests for each unit which have the following characteristics:

(1) They should take no longer than 15-20 minutes to complete. Longer testing times tend to be psychologically depressing, since the tests are given so often.

(2) The test should measure every performance objective contained within the unit, or should not address any skills not mentioned or addressed by the unit.

(3) Each test must have a clear, precise, and detailed answer key available for use by the proctors. While they are highly trained, an unambiguous and detailed statement of the expected answer to a problem or question greatly aids them in working at a high level of competence.

(4) The tests must be criterion-referenced, rather than norm-referenced.[39] This means that the tests must be designed to measure student achievement against an absolute standard, rather than against other students. This is an extremely important distinction, one which should be taken quite seriously. The credibility of the course will be destroyed if the tests are designed to "weed out" students rather than to measure mastery of the material.

The format of the tests may be totally flexible, based upon the wishes of the instructor and the cognitive level of the material. The fundamental consideration is to maintain consistency between the initial course demands and the test demands. If you want to set the cognitive level of the material to be learned very high, state this in the objectives, then test at that level. If this consistency isn't maintained, credibility will again suffer.

The number of different tests one prepares for each unit should be in the range of 4 to 6. Any fewer doesn't produce enough variation for most classes, and more than this isn't really necessary for the learning process. The fact that the general content of the tests becomes known through the communication between students is nothing to become alarmed about for two reasons. Firstly, if the objectives were properly defined and the tests constructed based on these objectives, the students will know what to expect anyway. Secondly, the nature of the grading process is such that just knowing the answer is not enough for a student to pass the quiz. The proctor can and usually does ask for clarification on at least one or two points, in order to test the student's mastery of the material. It is quickly apparent to the proctor if the student doesn't know the material, and the proctor has the right to discount a correct answer if the student shows no ability to discuss the answer or where it came from.

Regarding the number of quizzes a student will take before achieving mastery, rarely are more than 3 needed for any given unit. If more than 3 quizzes are needed, the student probably needs some counseling to clear up what is probably a fundamental lack of understanding of one or more concepts. Helping people in this situation is a responsibility of the instructor. An alternative to continued administration of quizzes is to allow the student who has mastered all but one concept or objective to work only those portions of another quiz which pertains to that objective. In this way, an exercise may be prescribed which will reinforce the mastery of that objective without using inordinate amounts of proctor resources and student time on those activities which have already been mastered. This practice should be used selectively, however, and usually only by the instructor.

If the capability exists for the use of computer-generated repeatable tests within the instructor's institution, the PSI learning format certainly offers an excellent opportunity to make use of it. Again, it should be pointed out that the test items must be criterion-referenced, and large numbers of these may have to be written by the instructor before the course begins.

Research on the testing process is not abundant when related to PSI, but some of the results which have been reported are interesting and offer the possibility of some imaginative alternatives. Minkin, et. al.,[40] and Johnson, et. al.,[41] have both found that there seems to be little if any significant difference in learning, whether the unit quizzes are administered orally or in writing, as measured by written posttest scores. Surprisingly, the orally-administered tests required less total time than the written tests, when both student and proctor time was considered. The differences in the studies and the uncontrolled variables present make any firm conclusion difficult to reach on the basis of the above studies, and further research should be done. Johnson, et. al.,[41] have applied an interview technique, with no apparent loss of effectiveness, and Semb[42] has even found that little difference exists in the amount of learning which results when students are asked to submit their study guides for grading versus requiring the students to take written quizzes over the same material. The grade in both cases was based solely on the student's performance on a comprehensive final

examination. A case has even been reported[43] where students have graded their own quizzes and have shown no loss of performance on the final. In both of the above cases, the strong contingency of a comprehensive final exam may be a major factor in the observed results.

It has been uniformly and widely confirmed [34,44,45] that the mastery criterion which is perhaps the most important component of PSI, is essential to learning. The level of performance demanded on the unit tests shows a strong and direct correlation with posttest scores--the higher the performance criterion, the more material is retained. Levels above 90% should be avoided, however, for expecting perfection is frustrating to all concerned.

Related to, and forming integral parts of, the testing materials are the proctors and the proctor materials. This subject was alluded to above, but much greater coverage should be given to the role and influence that proctors have. When choosing proctors for a PSI course, there are several sources which may be tapped. The primary source which often yields the best proctors is that class which has most recently completed the course sequence. The proctors chosen from this group will show a tendency to be the most enthusiastic and the material will still be fresh in their minds. Additionally, this group will experience the greatest revelation and insight as they begin to teach the material they have learned as students, only to discover that they didn't know it as well as they thought.

A second source of proctors is the class currently enrolled in the course sequence. There are mixed reports in the literature regarding the use of "internal" versus "external" proctors, but the two systems appear to be nearly equal in effectiveness in some situations.[46,47] When internal proctors are used in a PSI course, they are often chosen from the ranks of the students who progress the fastest. In many cases, proctorships rotate among many members of a class, either as a reward for progress or as a learning technique in the "student-as-teacher" mode of thought. We have found,[7] however, that internal proctors are much less effective in the Health Sciences, perhaps for the following reason. The courses in which the above internal proctoring strategy has worked have often been Psychology courses in which it is presumed that the interactions which occurred among the students in the class were more or less limited to that class. In the case of the Health Sciences, the students are likely to be members of a professional school class and be peers in all of their classes. This broader peer relationship seemed to contribute to a greater difficulty of adjustment on the part of many toward the internal proctors. This may be due to the strain placed upon the peer relationship by the changing roles of the proctors from class to class. Further evidence would be necessary to confirm this, and it is presented as a point of consideration only.

The third type of proctor which may be employed is the graduate student teaching assistant. The advantages of employing graduate students in the role is that they bring (presumably) a greater level of expertise to the job, and secondly, they are usually paid by graduate stipends from the instructional unit sponsoring the course. The major disadvantage lies in the fact that many graduate students see themselves in the role of instructor or professor, perhaps emulating the course instructor. In this role, they often have a tendency to try to impress or lecture to the student instead of performing a counseling and guiding function (*vide infra*).

Before choosing external proctors, some suitable reward for them must be devised. This reward usually takes one of two forms, and both may exist simultaneously, but not for the same individual. The first reward, usually the preferred one as far as the instructor is concerned, is the awarding of some number of course credits for the proctor's services. The course credit is usually justified by the increased insight the proctor receives into both the subject and the teaching process. While the credit given cannot be for the course being taught, if a "special topics" course exists, credit may often be arranged through it. The second reward is money. While it is nearly always easier to award course credit than money, in some circumstances it may be necessary to pay the proctors an hourly wage. The advantage to this arrangement is that the proctor function is one of the few part-time jobs available to students which has both good hours and working conditions as well as the opportunity to learn as they work.

Having recruited proctors, what steps must the instructor take to insure their highest level of competence and effectiveness? The most basic principle to follow is to *be supportive* and *train them well.* The proctors are figuratively and almost literally the extension of the instructor, and although each proctor will have many unique traits and styles, the training they receive from the instructor will set the tone for the interactions they will have with students. Specifically, the areas which must be addressed are the following:

(1) Define the proctors' role precisely and carefully. Let them know exactly how far their authority extends and what the procedures are for handling challenges and disagreements. Inform them of anticipated situations which they may encounter.

(2) Provide detailed answers to the questions on the tests--not just the correct answer, but the manner in which it should be approached, the concepts addressed, and some suggested discussion points and references. This material will serve as a guide for the proctor as he or she grades the student's test, and the more complete it is, the better prepared the proctor will be.

(3) Encourage the proctor to *interact* with the student, beginning with a greeting and good eye contact. It is the proctor's responsibility to set the student at ease and draw out the knowledge or opinions the student has. In this regard, two most important abilities the proctor can have is the ability to communicate with the student and the ability to relate the material at the student's level.

The number of proctors needed, of course, will depend on the size of the class, as well as other factors such as the number of testing hours which are scheduled and the shape of these blocks of time, the number of units to be completed in the course, and the degree which the instructor is able to participate in the grading process. With all factors optimized, the maximum ratio of proctors to students should be no greater than 15:1, and we have observed that a ratio of about 10-12:1 approaches the ideal.[22] This ratio is based upon a course which moves at a pace of about one unit per week and which meets for testing about 9 hours per week in 3-hour blocks for a class of 130 students. Others have recommended ratios as low as 7-8:1, but if some degree of management is applied, it is not necessary to have this many proctors.

Course Policy and Administration. The third category to be considered in establishing a PSI learning environment is that of administrative details. The major points to be made are logical outgrowths of the characteristics of the method, and many have been discussed in earlier parts of the article, but it is useful to sum them up in one place.

The first point to follow in administering a PSI course is to put everything in writing, in a precise, accurate and unambiguous manner. Include in a course policy statement, at the beginning of the course, items such as the grading policy, number of units to be completed, testing hours and rooms, and any other information the students need to best understand the PSI method and what is required of them.

Hold the mastery requirement high. One effective strategy is to insist on perfection on all material and tests, then allow the student to make one mistake out of ten, or operate at the 90% level. Make certain that the one item out of ten which is incorrect is corrected, so that the student gains an understanding of all concepts addressed by the unit (remember, if it's not important, it shouldn't be in the unit or on the test). If the mastery requirement is lowered, not only does the degree of learning fall off (as mentioned earlier), but the degree of attempted bargaining can increase between the students and proctors and this can beget a loss of morale in the class. If the students know that the material must be learned absolutely and they are suitably encouraged, they will learn it and enjoy the experience as well.

The class testing hours were mentioned briefly in the preceding section. Many differing schedules have been used in the past, from as few as three hours per week, which is probably inadequate, to unlimited testing hours, which is neither practical nor desirable. Experience has shown [22] that 6-9 hours per week of testing is in the range of the ideal, at least for a class of 100 students. It can be most effective if it is divided into three-hour blocks. This block size gives the student time to take a test, have the test graded, and retake a second test if necessary. This limited time allotment assures that there will usually be a significant amount of activity at each session. Interestingly, there seems to be an advantage to having a "critical mass" of learners present, and that individual learning may be enhanced by a higher degree of activity in the testing area.

Other advantages of limited testing time include the potential for increased management efficiency of the instructor's and proctors' time. If testing is to begin at noon, for example, there will be no large demand for proctors until perhaps one-half hour into the session. Thus, scheduling the proctor arrival for 12:30 saves a half hour of unproductive activity for them (it also saves money if they are being paid).

The requirements for physical facilities are quite flexible, as long as the area is large enough to accomodate everyone. If all of the course functions occur in one room, it should be large, so that the functions may be separated to some degree. If the room is a lecture room, it should have a capacity of

at least twice the size of the PSI class, and a factor of 3 is even better. The grading functions should be separated from the testing functions to minimize interference and distraction of those taking tests, since the grading activity can become quite lively and enthusiastic. The two functions can be put into two rooms, if desired, and the proctors may be stationed at carrels if these are available. It is also useful to have a lockable file cabinet available in the testing area where the materials may be kept. In spite of these desirable features, PSI is remarkably independent of requirements for physical facilities, and they will not usually be a determining factor in its success or failure.

One policy question which invariably occurs in setting up a PSI-based course is whether or not to give a final exam. While there are many people who argue that a comprehensive final is inconsistent with the philosophy of PSI, the advantages of a final would seem to heavily outweigh the risks of bastardizing the system. One of these advantages include the greater degree of integration of the student's knowledge which seems to occur when the passing of a final is one of the contingencies of the course. The unit material is perhaps studied from a different perspective if the student knows that the material will appear again on the final. A second advantage is that it is easier to satisfy critics of the method if one can report that the final exam scores were respectably high. It is also a necessity if one is attempting to reach some conclusion of the method's comparative effectiveness at promoting learning. The final may serve as an effective posttest in itself, or it may contain the elements of a posttest, depending on the desires of the instructor. One other substantial advantage lies in the fact that it gives the proctors an "out" when pressed by a student for a passing grade on a unit. The statement, "Sure, I could pass you, but you'll only see this material again on the final," holds remarkable weight.

The relative importance of the final exam is usually left up to the individual instructor, but historically it has counted from 25-100% of the course grade. Below 25% contribution, the final may not be taken seriously by all students, yet counting the final as 100% of the grade is not really fair to the student, since a great deal of work was put into the course just to arrive at the final. Additionally, a grade based 100% upon the final exam is a return to the inappropriate practice of requiring everyone to perform "on cue," rather than when they are at their best.

Another factor which has generated some controversy is the assignment of grades in the course. Some maintain that if the student completes all the units, he or she should receive an A grade. Others also require the passage of a final exam to receive an A grade. Occasionally, the grade for the course will be based only upon the number of units passed. If this occurs, then the essential units must be included in the "core" or minimum grade group, with the nonessential ones forming the optional group. This policy may seem inconsistent to some, since one of the basic premises of PSI is that if it's important, it will be included, and if it isn't, it won't. PSI is really more flexible than this, however, and several people have used this method successfully. In short, choose the system which is most comfortable both to you and to your administration, since the assignment of grades is not a component of PSI, but rather of the educational environment.

The question of grades of "I" (incomplete) invariably arises in a PSI-based course. Regarding this, experience has shown[7] that the use of the I grade will be determined by a number of factors, such as administrative attitudes, instructor philosophy, and time constraints. Theoretically, any student who doesn't complete the sequence by the end of the term should receive an I, on the basis that time is flexible and the college grading schedules are not, and this may be done. Many instructors have found, however, that unconstrained progress through self-paced units approaches an infinite limit, and that students, being human, will always put off that which isn't demanding their attention.[48] One compromise solution to this dilemma is to constrain the self-pacing to the course boundaries, i.e., give the students complete time flexibility within a time frame of one quarter or one semester. At the same time, purposely neglect to mention the I grade. Above all, don't promise it to those who don't finish. At the end of the term, consider those students who haven't completed the material on a case-by-case basis.

Another point of concern is the manner and degree to which records are kept. Almost by definition PSI requires more paperwork than a lecture sequence, due to the increased number of tests given and the necessity to maintain a progress file on each student. One convenient way to maintain class records is to designate a file which contains a folder for each student. In this folder will be kept all the student's tests, lab reports, papers, etc. This file should always be accessible to the student when it is requested.

A class progress chart is also a useful device to maintain. By posting this chart, each student, as well as the instructor, can gauge both class progress and the progress of individuals. The chart, in this way, serves as one of several effective antiprocrastination measures, since a degree of peer pressure is felt by students who see themselves falling too far behind the pace of the class.

The records which should be kept are not unlike those kept in a traditional course: the student's name, the numbers of the units passed and the date on which each was passed. The scores on each unit can also be of interest for statistical purposes, although they shouldn't appear on the progress chart. The major difference between these records and a traditional gradebook is that the date must be recorded for each student's test, rather than for one group of midterm grades.

One overall administrative point which *must* be followed, above all, is that if the instructor wants to utilize PSI to improve learning, he or she must be present in the testing room most of the time that testing is in session. The instructor plays several roles in the classroom, including arbitrator of disagreements, test grader, tutor, source of expertise in discussion sessions, a resource for the proctors, and manager of instruction. Just as important as all of these functions are the psychological benefits that accrue from the instructor's presence. The students are told initially of the concern for the individual, the positive reinforcement aspects, the effort that will be made in PSI to help them learn. If the instructor attempts to implement the system and then spends little time managing it, the students will quickly recognize all of the initial talk as a sham and will tend to "drop out." *This point cannot be overemphasized.* If an instructor is considering PSI as a method which will provide more free time or less effort in teaching, he or she doesn't understand the essence of the system. When PSI is functioning properly, the instructor experiences *more* time demands than in a traditional sequence, not less. The average demands on the time of an instructor in a moderately-sized PSI sequence (ca. 100 students) might be 6-8 hours/week, not including the time it takes to prepare the learning units and write the tests. Thus, PSI is not the educational panacea which will allow maximum learning through minimum effort of the instructor, and which will allow maximum time for research and other activities. It is instead an extremely effective system of instruction in which the students, proctors, and instructor work harder than they probably ever have before. The rewards for this hard work are fully worth the effort, however, for in no other system will one see and experience the excitement of learning so clearly.

One administrative point which has been alluded to earlier is the inevitable problem of procrastination. This is a serious problem which results at least in part from human nature and in some cases from the prior experience of the students. In PSI, the student is given primary responsibility for the management of his or her academic affairs. There is no one who is going to prod them to finish a unit or hold the club of a midterm test over their heads. Without this inducement to keep up with some arbitrarily defined rate of progress, it is human to procrastinate on the completion of the units, particularly when other traditional courses are placing much more immediate demands on the student. To compound the problem, a significant number of students will never have experienced the responsibility of self-management, and will have a degree of difficulty handling it effectively. Because of these tendencies, one of the objectives of the course administrator is to provide as many inducements as possible to encourage the students to maintain a reasonable pace of learning. The tricky part of reaching this objective is that only positive inducements may be used. To force the students to keep pace by threat of punishment (such as a low grade or failure) is in direct opposition to the principles on which the system is based. The following is a list of some techniques commonly used to overcome the problems of procrastination in a positive way, including those which were mentioned earlier.

1. Post a progress list so that each student may note his or her position relative to everyone else. This technique makes use of an element of peer pressure.
2. Make the units short, so that the prospect of completing one doesn't seem like a large undertaking for the student.
3. Make the first unit or two easy, so that the student's confidence is built up quickly.
4. Minimize the time the students spend waiting to have their quizzes graded by a proctor. Schedule the proctors' time to optimize their efforts by matching their schedules with the busiest testing times.
5. Give optional enrichment lectures which the student may attend only upon the completion of a

particular unit. Be sure not to cover any essential material unless it is also covered in the unit or text.

6. One very effective technique is to utilize a "bonus point" system which awards a student a bonus point for completing a unit by a particular date. The bonus points may be counted toward the final course grade, or toward the student's score on the final exam. It is important to assign the proper weight to these points, for if they count too much they will become ends in themselves and if they count too little, they will lose their incentive value. They should not form part of the required points on which the grade is based, but should be extra points. Up to 10% of the course grade may be represented by these points, but it must be possible to achieve an A grade totally without them.
7. Offer an early final to those who finish early. It may be given 2-3 weeks before the end of the term. If given earlier, most students will become discouraged at the fast pace and give up trying to qualify. If given too close to the regular final, it will again lose its incentive value. If desired, added incentive may be added by allowing those who take the early final to also take the regular one if they want to raise their score.
8. Monitor the test and time statistics carefully, being alert for difficulty or slowing of pace on any particular unit. Then concentrate on rewriting that unit before the course is offered again. Units which are difficult due to lack of clarity will be plagued by procrastination.
9. Minimize "I" (incomplete) grades by not encouraging them. Preferably, don't even mention them. If the students know that there is neither pressure to finish nor penalty for failing to finish, many won't.
10. Make a suggested pace list available which suggests the rate at which one should ideally proceed. This may be tied to the above bonus point system, if desired.
11. Schedule enough convenient testing sessions to encourage the student to become involved in the system. Minimize testing times which conflict with other classes which the majority of students are taking. Don't have too much testing time. This encourages procrastination through the "there will always be another session" syndrome.
12. Carefully train the proctors to interact on a personal level with the students and to make the interaction pleasant. This positive experience will then reinforce the continued progress through the units.
13. Participate personally in the PSI environment. Don't delegate all the authority to the proctors. If the instructor shirks his or her course responsibility, the entire course atmosphere will quickly become demoralized and procrastination will flourish.
14. Contact stragglers personally, either by phone or mail. Express your concern for their progress and inquire whether you can be of help. Don't use threats.
15. Use punitive measures only as a drastic last resort. If these have to be used, something is wrong somewhere else in the system.

At this point, a brief summary of the most salient aspects of a new PSI course may be of value. If anyone who wants to implement PSI follows the ten points below and their ramifications, the course should be successful.

1. Don't deviate from the standard formula the first time. Every element of PSI has a purpose, and until you gain enough experience to evaluate the importance of each element in your particular situation, keep PSI, not SLI.
2. Don't try to implement PSI in a course with which you are not familiar. Since the written materials take a considerable time to prepare, an elementary, stable subject is a better choice for PSI than an advanced, rapidly changing one.
3. Begin preparing the units early, at least 3-6 months before the sequence will be offered.
4. If you err in judgement concerning the logistics of a course, err on the high side rather than the low side. It is better to have too many objectives, too many units, too many testing hours, too much room, too many proctors, or too many tests, rather than too few.

5. Treat PSI as the completely different system that it is. Its philosophy of operation is totally different from the traditional approach. The potential of this system is very high, but to reach it, a great deal of hard work must be put into it. The more effort put in, the more value will come out.
6. Stay in the classroom and get involved. Interact with the students, respond positively as much as possible. Don't consider PSI as an opportunity to have someone else do your teaching for you. If your PSI course is working correctly, you will have more work, not less.
7. Keep the system simple. Given any choice, choose the simplest answer to the problem.
8. Recruit the proctors carefully, not only upon the basis of proven scholastic ability and mastery of the material, but also on interpersonal communications skills. The best proctors are people who not only know the material, but can effectively communicate it to others and enjoy doing it.
9. Keep records of everything you do and everything that occurs. If you find that records are not needed later, they can be discarded. If they are not kept initially, they are lost forever.
10. Seek the support and encouragement of the administration for your efforts. Don't proceed without it, for you will need some highly placed allies to help you defend the system and explain it to those who don't understand it. Until the system is understood, you may have trouble convincing colleagues of the validity of the higher grade distribution which results from its successful use.

Questions Raised by PSI. The PSI method, being so fundamentally different from traditional instruction, has understandably caused its share of controversy in the world of higher education. Many of the components of the system are still being investigated, and there remain many unanswered questions regarding its use. Some of the more controversial questions may not even have an answer, which makes them even more worthy of discussion. Some of these areas of controversy will be highlighted here. No answers will be provided to the questions raised, but it is hoped that the brief discussion will stimulate thought on the subjects.

One issue which reflects a difference in philosophy is that which relates PSI to real life. The opposing sides of this issue both make valid points. The opponents of PSI state that it "coddles" the student, and that deadlines and punitive consequences are a reality. The argument is made that if the student is not taught to deal with these facts of life, failure in the real world will be eminent. The proponents of PSI agree that the real world does have deadlines and punitive consequences for not meeting them. The argument is extended from this point to the fact that the most effective way to deal with these real world contingencies is to possess the skills to manage one's own affairs and one's own time. If this premise holds, then PSI is acutally more effective than traditional methods at teaching this skill. It places the student in the position of being responsible for his or her own actions, yet does it in such a way that the lesson of effective personal management may be learned without disastrous consequences.

A second area of controversy is concerned with the levels of taxonomy at which PSI is most effective or most ineffective, and there is yet no clear-cut answer to this question. The argument is often made that PSI may be good for teaching elementary facts but would be a colossal failure if it were applied to Art, English, Philosophy, or any advanced or abstract subject where the cognitive levels of synthesis, analysis, or evaluation are involved instead of simple recognition and recall. In fact, all of the above subjects have been successfully taught using PSI (at least in the opinion of the respective instructors).[49] The response which may be given to the above statement is that just as PSI has not been fully shown to be effective at teaching higher level skills, neither have the traditional methods. Traditional education has not been any more successful at teaching creativity than PSI, and in this sense, PSI should not be asked to prove something that traditional education cannot prove either.

One discussion which often occurs centers around the question of whether or not PSI teaches other skills unrelated to the subject at hand. For those who have used PSI, there is often an intuitive feeling that many students are learning or improving communication skills and peer interaction skills. We have often observed that many students who show a tendency to be deficient at self-expression make remarkable progress toward the development of these skills when called upon to practice them in discussion with proctors and other students.[22] Little if any research has been done on these anecdotal and unsubstantiated reports, although one study has attempted to measure the effects of efforts to encourage peer interaction in the classroom.[50] The results, however, are too preliminary to reach any conclusions, but the question will undoubtedly be addressed rigorously in the future.

The final point for consideration is one which is at the heart of higher education, at least from the point of view of the instructor. This is the question of whether the time and effort of PSI is worth the trouble, in light of the basis for promotion and tenure at most major universities. It is a well-known fact that innovative teaching in itself counts as only a small part of the total evidence weighed in promotion decisions, and until or unless this changes to reflect a better balance, one should carefully weigh one's career goals and the realities of the particular educational environment before undertaking a major commitment to PSI. As has been mentioned earlier, if it is working well, PSI will take a substantial portion of an instructor's time, which is time away from other scholarly pursuits such as research. One dilemma which the motivated and innovative instructor may face is whether to really try to optimize learning and motivate the students to a high degree with PSI, or whether to continue with the traditional lecture-midterm sequence and utilize the time elsewhere. The choice each instructor makes will be a reflection of a complex series of factors, but perhaps with the help of some of the information in this article, the decision will be based on a greater familiarity with the methods and the issues involved, even though the coverage of the subject is far from exhaustive.

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INSTRUCTIONAL DEVELOPMENT FOR A COMPETENCY-DETERMINED CURRICULUM

Constance M. Greco

INSTRUCTIONAL DEVELOPMENT DEFINED

The instructional development process is a systematic planning approach to the design of instruction. It generally involves an instructional developer and a person with content expertise working closely together through two major stages, planning and production. In the planning stage, information is gathered which might impact on the design of the educational experience. Information about the area of knowledge, the students, the institutional priorities and the community needs are systematically collected and analyzed. From this analysis, overall course goals are established and general guidelines for the course or sequence of instruction are devised. Finally, an operational design, or workable education approach is devised. This is what the program will really look like. It is now ready to move into the production stage.

During the production stage, the course design is implemented. Specific objectives for the course or components of the course are developed. Any necessary materials are produced. An evaluation plan is devised. The course is then offered, evaluation data gathered, and necessary revisions are made. This, then, is the basic process usually meant by the term "instructional development."

THE RESPONSIVE DESIGN METHOD OF INSTRUCTIONAL DEVELOPMENT

Here at the College of Pharmacy, University of Minnesota, however, we had two further factors to consider: the specified competencies and the existing faculty. Since the competencies were both derived from and and validated in actual pharmacy settings, they did not always represent the personal biases of instructors about goals for their own individual courses. It was important, therefore, to concentrate our early efforts on involving faculty in the curriculum change process.

How could this best be done? It was decided to begin on a "grass-roots" level, using an approach we are choosing to call "The Responsive Design Method." This method was designed to respond to two needs: the instructional design needs of individual faculty members and the training needs of individual students.

Building Instructor Involvement

The Responsive Design Method is based on the assumption that a vital factor in ensuring maximum impact on the student is the involvement and commitment of the instructor. Therefore, curriculum development is begun on the course level. By moving first to a course level we recognize the expertise of the faculty as

professionals in their own field. As such they cannot, and should not, be told when and what to teach. Rather, involvement in the design of their own instructional units is emphasized. In this way, the instruction belongs to the faculty member who has designed it – the faculty member "owns" the instruction. This feeling of ownership appears to be a vital factor in ensuring maximum impact upon the students being instructed.

Meeting Student Needs

The change which is to be implemented in the curriculum, however, must meet the training needs of the individual students as well as the design needs of the faculty. Therefore, it is important that the faculty member designing instruction examine not only his/her own personal goals for the course, but the relationship of these goals to the validated competencies. In addition, such factors as individual differences among students, the priorities of the College of Pharmacy, and the needs and directions of the field of pharmacy should be considered.

Using the Responsive Design Method

How does the Responsive Design approach actually work at the College of Pharmacy? Faculty interested in redesigning existing courses, or in designing new courses, contact the instructional developer who works on a one-to-one basis with them. In this approach, six basic steps are used (see Figure1).

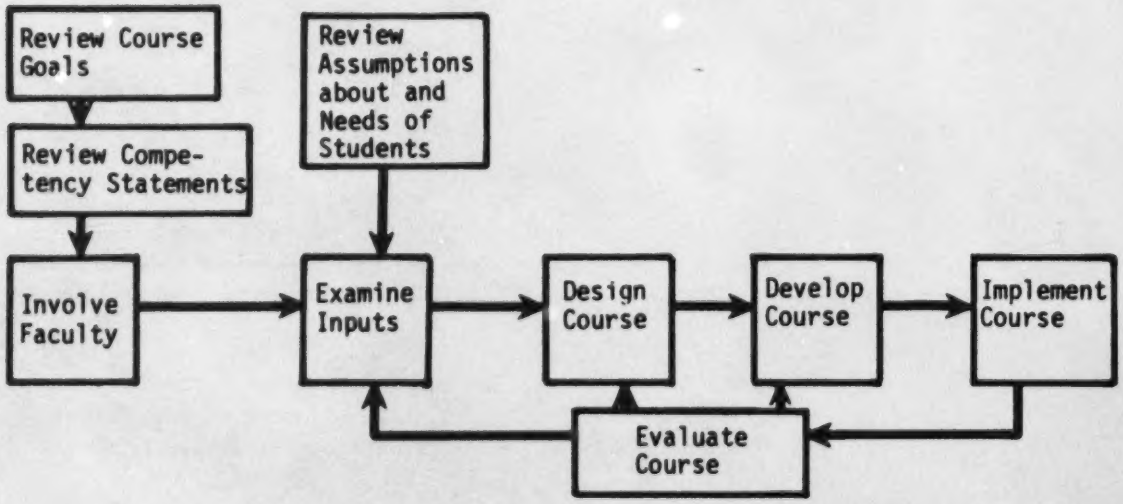


Figure 1. RESPONSIVE DESIGN METHOD: COURSE LEVEL

The first step is to involve faculty in the design process. This is most easily done through a dialogue stage with the faculty. At this point, faculty are encouraged to freely consider the goals that they have for their students. What do they feel students should know? What skills should they develop? How would they describe the student who had successfully attained these goals? Once the goals have been delineated, they can be discussed in terms of the competencies. Which goals relate to which competencies? How do they relate?

The next step is one of examination. The developer, through a series of questions, assists the faculty member to examine a variety of inputs. First, the rationale for the stated goals: Why is it important that students learn these things? Should all students achieve all the goals, or are some goals optional? Then the students themselves: Who are the students for whom this course is being designed? What do they already know? How are they similar? How do they differ? What are their priorities, their needs and their expectations in relation to the knowledge area? The institutional priorities: What are the needs of the College of Pharmacy? What types of programs will it support? Where do its priorities lie? And finally, the needs of the field: What competencies does a student need for hospital pharmacy? For community pharmacy? How do these relate to the course being designed?

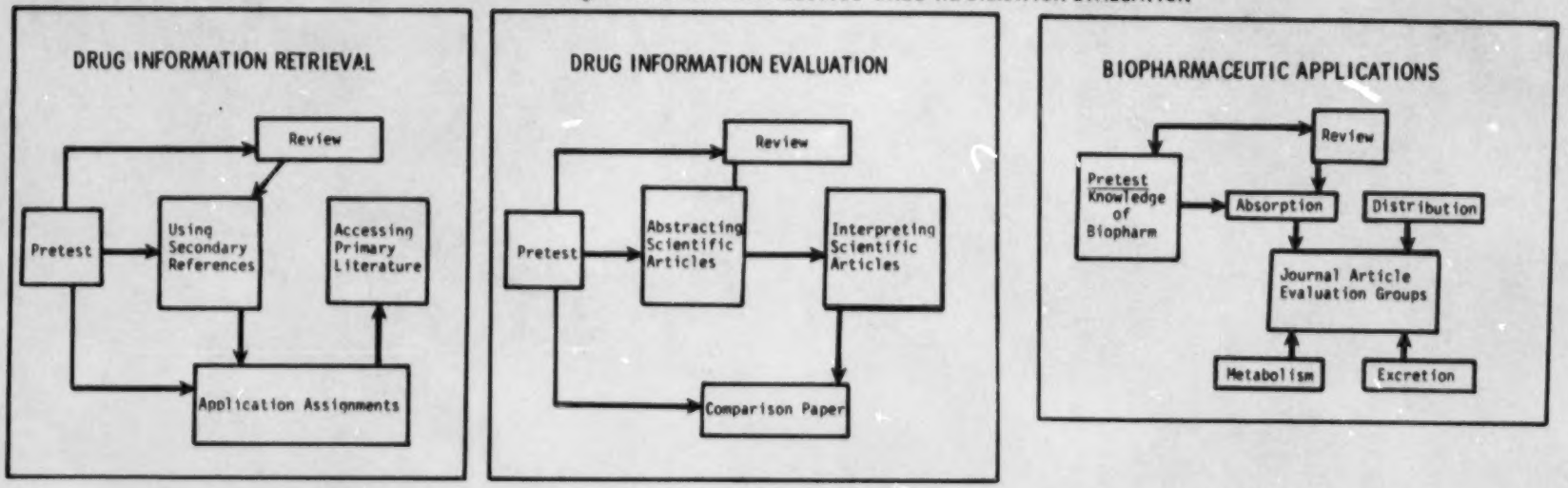
Once the inputs have been examined, a course design is devised. (For example see Figure 2) This design is merely a road map, a skeleton from which the course will be developed. Its object is to provide a tool for communication, a plan of the proposed course layout from which to stimulate discussion. In this way, important issues that might not otherwise be raised can receive attention in the early planning stage. The result is frequently increased efficiency in the production, implementation and evaluation stages of course development.

The next step is to develop the course. Each segment of the diagram, or road map, for the course is considered in terms of its objectives and intended outcomes. Based on this, decisions are made about the best educational experiences to reach the intended goals or produce the desired outcomes. It is at this point that materials must either be identified or produced to support the defined educational experience. Two examples of materials being produced at the College of Pharmacy are the student manual and the independent learning sequence.

Due to the scope of this curriculum project, it is being recommended that all faculty give serious consideration to the development of a student manual. At a minimum, the student manual addresses five areas: (1) Goals: What Will I Learn; (2) Rationale: Why Should I Learn This; (3) Activities: How Will I Learn; (4) Individual Differences: What if I Need to Review? What if I Already Know; and (5) Evaluation: How Will I Be Judged? In this way, the information is clarified for the instructor teaching the course, for the students taking the course, and for other faculty of the college. This can provide a useful forum for determining both overlaps and gaps in the overall developing curriculum.

In every course there are basic facts to be learned, facts that instructors repeat in lectures over and over again. The courses in the College of Pharmacy are no exception. Therefore, certain segments of each course content lend themselves naturally to the development of independent learning packages. Independent learning packages, as we use the term here, are segments of instruction from which students can master the pre-specified objectives with minimal input from an instructor. As can be inferred from this definition, independent learning packages are, of necessity, self-paced. They are designed to accommodate themselves to the individual differences in rate of learning which exist among all students. Students generally move through the learning packages at their own rate, with mastery of content, rather than speed, as the criterion for judgment.

Figure 2. BIOPHARMACEUTICS-DRUG INFORMATION EVALUATION



L4

These independent learning packages, which may be either in print or mediated format, will probably be an appropriate part of nearly every course development effort.

In the courses currently under development at the College of Pharmacy, independent programmed segments on such topics as drug information retrieval, drug-induced diseases, consumer medicine, antimicrobials and over-the-counter (OTC) drugs are either being considered, produced or field tested. These, then, are common examples of materials that might be produced during the course development stage.

Once the course has been planned, and the necessary materials and means of evaluation developed, it is ready for implementation. This is the actual offering of the newly designed course. Implementation should, however, be heavily interfaced with evaluation. This is due to the necessarily repetitive nature of instructional development. A systematic move toward instructional improvement involves the design of new approaches, their implementation in an actual course setting, gathering data on how they succeeded or failed, and revising based on this data. Therefore, at this point as much information as possible is gathered in order to make decisions about maintenance or revision during the evaluation stage to follow.

In the courses under development at the College of Pharmacy, evaluation data is gathered on each class session, assignment or segment of instruction. For example, in the Biopharmaceutics-Drug Information Evaluation course currently being implemented, class sessions followed by assignments applying the knowledge are the two major instructional components. Students are asked to fill out forms designed to gather evaluation data on these two components after each session or assignment. (See Figure 3 and 4)

The data gathered during this implementation stage is then analyzed and reviewed to see what changes need to be made. Based on this review, decisions might be made to reexamine original inputs, to modify the course design, and/or to revise the existing materials or to develop new ones.

This, then, is how the Responsive Design Approach is being applied on a course level at the College of Pharmacy.

THE CURRICULUM COHERENCE PROCESS

The process by which courses are designed in the College of Pharmacy has been described. But how will the larger task of curriculum redesign based on the competency concept be approached? For this task we have devised the Curriculum Coherence Process. (See Figure 5)

The Curriculum Coherence Process is based on the concept of building a cohesive and logically consistent curriculum. Through thorough examination of courses, it is expected that a certain pattern of sequencing and combining will become obvious. In addition, areas which are not receiving adequate coverage will be discovered. This information can then be used to form the basis for effective curriculum revision.

Building the Coherent Curriculum

The Curriculum Coherence Process has been designed to begin on a course level. Since curricular revision is, by its very nature, a change activity, it must be approached carefully and in a manner that threatens neither the dignity nor the academic freedom of those it purports to serve. By beginning on a course level, working with individual faculty members, curricular change will support rather than suppress the personal concerns of the faculty.

FIGURE 3 **CLASS SESSION EVALUATION**

Phar 5-670 Date _____

Please check the most appropriate alternative:

1. I found this class session:
   - ____ extremely interesting
   - ____ interesting
   - ____ somewhat interesting
   - ____ uninteresting
   - ____ boring

2. I learned:
   - ____ a lot
   - ____ some
   - ____ very little
   - ____ nothing

3. What I learned was:
   - ____ very useful
   - ____ useful
   - ____ somewhat useful
   - ____ useless
   - ____ a total waste of time

4. The information was presented:
   - ____ much too fast
   - ____ a little too fast
   - ____ just right
   - ____ a little too slowly
   - ____ much too slowly

5. The information in the session was:
   - ____ very clear
   - ____ clear
   - ____ slightly confusing
   - ____ very confusing

6. I would rate this class session as:
   - ____ excellent
   - ____ good
   - ____ fair
   - ____ poor

7. Please write at least one specific comment on this class session here. Thank you.

FIGURE 4 **APPLICATION ASSIGNMENT EVALUATION**

Phar 5-670

Assignment Title:———————————

_____

Please check the most appropriate alternative:

1. I found this assignment
   —— very useful
   —— useful
   —— somewhat useful
   —— useless
   —— a total waste of time

2. I learned:
   —— a lot
   —— some
   —— very little
   —— nothing

3. In relation to the goals and competencies for this unit, the assignment gave me:
   —— excellent practical experience
   —— some practical experience
   —— very little practical experience
   —— no practical experience

4. The instructions for completing this assignment were:
   —— very clear
   —— clear
   —— slightly confusing
   —— very confusing

5. In relation to what I learned, the assignment took:
   —— far too much time
   —— a little too much time
   —— an appropriate amount of time
   —— very little time

6. Doing the assignment was:
   —— extremely interesting
   —— interesting
   —— somewhat interesting
   —— uninteresting
   —— downright dull

7. I would rate this assignment as:
   —— excellent
   —— good
   —— fair
   —— poor

8. Please write at least one specific comment on this assignment here. Thank you.

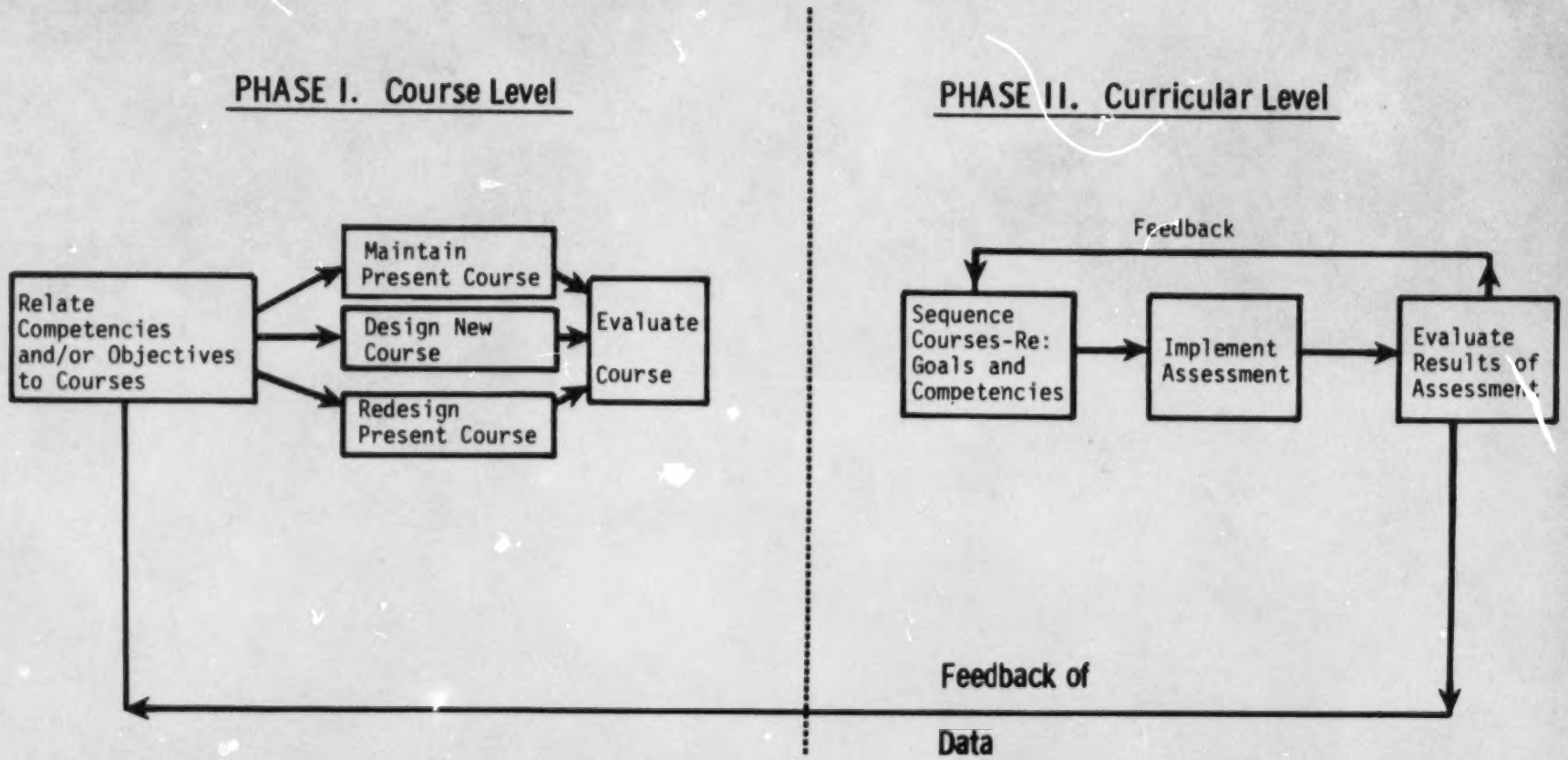


Figure 5. THE CURRICULUM COHERENCE PROCESS

Faculty may choose the method by which they become involved in the curriculum revision effort. Rather than committing themselves immediately to a full redesign effort, they may prefer to evaluate their existing courses. In this case, they would receive assistance in devising tests to determine if competence or objectives leading to competence which they felt were addressed in their courses were actually being mastered by students. In this way, redesign efforts would be encouraged by empirical data.

When a number of courses at varying levels in the curriculum have been examined, some understanding will be obtained of where, in the overall curriculum, goals and competencies are, or should be, addressed. In addition, some idea of redundancies and overlapping instruction in the existing curriculum is gained. Using such tools as the Student Manuals devised for courses under development, the instructional developer can facilitate communication among instructors within whose courses the content redundancies occur. By combining course content to eliminate redundancies, required credit hours can be freed up to accommodate changes toward more logical sequencing and additions for more complete coverage.

It should be emphasized that the Curriculum Coherence Process is intended as a deliberate, systematic movement toward logical and effective change. It is heavily dependent upon examination and justification in terms of outcomes. Its ultimate aim is faculty consensus and commitment.

As the focus begins to shift from the course level to the curricular level, a shift must also occur in the manner in which student gain is evaluated. Since the goal of a competency centered program is to produce a competent professional, methods must be devised by which student movement toward this goal is assessed. Competencies, however, are syntheses of cognitive, affective and psychomotor behaviors and cannot be assessed by simple paper and pencil tests.

At the College of Pharmacy, assessment exercises are being designed to test mastery of specified competencies. Coordination of these assessment exercises with the curriculum is vital if the final goal of such assessment, the production of a competent professional, is to be realized. Exercises evaluating specific behaviors should follow instructional units designed to teach those behaviors. Thus, as students pass through segments of instruction, they will then be assessed by these exercises for competencies supposedly attained. Where the results are positive, students are mastering the behaviors as indicated by their performance on the assessment exercises, those instructional designs will form the basis of a competency-determined curriculum. Where the results are negative, students are not mastering the behavior, both the instructional sequence addressing those behaviors and the exercises assessing them will be evaluated for needed revision. Thus, a competency-determined curriculum will be developed through a design/implement/evaluate/revise sequence applied first on the course level with individual faculty, and then on a curricular level with groups of faculty.

SUMMARY

The instructional development phase of the Competency-Determined Project in the College of Pharmacy, University of Minnesota, was begun in September of 1977. In response to the unique demands of the project and the setting, a "grass-roots" approach to curriculum development was devised. This approach, the Curriculum Coherence Process, begins on a course level, then builds slowly toward a cohesive and logically consistent curriculum.

On a course level, the instructional developer works on a one-to-one basis with an instructor to systematically plan, design and develop courses responsive to the needs of that instructor. The process used for course development, the Responsive Design Method, attempts to build involvement with the curriculum effort as well as to systematically approach course design. This process involves six steps which may or may not

be followed in a linear fashion, but all of which should be considered. These steps are: (1) Involve faculty; (2) Examine inputs; (3) Design course; (4) Develop course; (5) Implement course; and (6) Evaluate course.

As more and more courses are examined and developed, appropriate sequence, combination of existing courses and addition of needed new courses can effectively be addressed. It is this process of course sequencing, assessing in terms of competencies, evaluating the results of the assessment, then feeding this data back into curriculum design that we refer to as the Curriculum Coherence Process.

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VALUES EDUCATION FOR THE HEALTH SCIENCES

Mick Johnson

This chapter deals with instructors and students. It deals with exploring, choosing and acting upon values — values which are so much a part of the health sciences and of the education that goes into the preparation of health science professionals.

The first part presento the basic knowledge of values education. The second part provides a look at the instructor and the teaching environment. The third part presents values education methods for the health science curriculum. And the fourth part provides a bibliography of readings in values education.

It is important for health science faculty and students to examine their values, make conscious values choices, and act upon the values which they consider important. Professionalism requires us to consider ethical questions, give opinions and advice, show commitment and provide leadership, all of which are highly dependent upon values and beliefs. This chapter is a start toward exploring, choosing and acting on values education in the health sciences.

SOME THINGS TO KNOW ABOUT VALUES EDUCATION

VALUES: Values are basic beliefs about what is good or ought to be which serve as guidelines for decision making and actions.

Values are not usually all you consider in decision making and acting, but they do play a part. Values are not always conscious, and that is part of what values education is about — helping people become more conscious of how they apply values. Every person has a value system. It is not just a matter of deciding that you value something. You must also decide how much and in comparison to what you value it. An important value might be teamwork, but when put in relation to other values such as success or achievement, teamwork takes on new meanings. Thus, it is important not oniy to examine each value you hold, but to examine its priority and relationship to your other values.

VALUING: Valuing is the process of developing values, of becoming aware of them and of applying them in making decisions and carrying out actions.

There is a lot to valuing. It is value development. It is value inquiry. It is making value judgments. It is analyzing values questions. It is choosing, prizing, affirming and acting on values. It is the feeling of liking and of disliking.[1]

SOURCES OF VALUES: We get our values from authorities, reference groups and our own experience.

The first and primary source of values for most people is their parents and their family when they are young. These are the people who teach values by what they do and say, what they expect and reward, and what they discourage and discipline. The second source of values is the reference group or groups of which the person wants to be a part. A person may accept the values of one group or many, small or large. Most people have reference groups throughout their lives which often change with job, age and community. The last source is personal experience. As a person reflects on what he or she has done or observed certain core values may emerge. That is, experiences affect the ranking of values and influence the individual's integration of different values into a personal set of values.[2]

VALUES EDUCATION STANCES AND APPROACHES:

These include values avoidance, values neutrality, values advocacy, values analysis, values clarification, values commitment/action learning.

Values Avoidance—is the position that values issues are not the proper concern of the teacher. Those who support this view believe that other institutions, the profession, and other individuals are the proper ones to deal with values matters. However, courses are organized around certain values, and instructors model certain values. Instructors are in the values education business whether they like it or not. The question is: are they going to be aware of it and deal with it?

Values Neutrality—is the position that values issues may be dealt with, but only objectively. That is, all sides of an issue may be surfaced and discussed, but the instructor will take no personal stance of his or her own. This approach raises the issues, but the instructor may be in conflict with these models and stances at other times. Student charges of aloofness and detachment are also likely.

Values Advocacy or Inculcation—is the approach which focuses on the content of the values being discussed. It holds that the instructor knows best and will lead the student to the answer. Methods used are: telling, establishing rules and enforcing them, and modeling. Of these, modeling has the most impact, especially when it is in harmony with the intentional or unintentional telling.

Values Analysis—focuses on understanding on how values work. It suggests that the person with the best knowledge will make the best decision. Methods used in this approach are: data collection, inference, analogy, rational thinking skills, stages of reasoning. Values analysis is often a part of several of the other approaches.

Values Clarification—is the widely used approach which focuses on individual awareness of personal values. Self-awareness activities, helpful confrontation for clarification, and solving of personal dilemmas are all techniques used in this approach. Much of this chapter concerns itself with this and the next approach.

Values Commitment/Action Learning—is the approach to values education which goes a step beyond analysis and clarification to focus on action. What do you do about your own values? The methods are generally action projects and ongoing evaluation with analysis and clarification activities. The key is to consider these projects as part of the values education process and to develop a supportive group in which action on one's values is considered good.[3]

VALUES EDUCATION GOALS: What the instructor works toward with the student.

Recognize Value Dimension—there are values present in every choice or decision. The valuing person accepts this as a given. The challenge is to identify the particular values at work when making every decision.

Accept Responsibility—we must be responsible for our values, beliefs and actions. It does not mean we make every decision in a vacuum or that we are really free to decide everything by ourselves. But the valuing person accepts responsibility for value decisions and actions.

Discover Options—when confronted with a situation which requires a decision, the valuing person attempts to do what we call predecision reflection. This involves several things, including discovering as many different options as possible. How many alternative actions can I think of for this situation? Are there alternatives I haven't thought of which others might suggest?

Consider Consequences—another part of predecision reflection is consideration of consequences. What might happen if each option were taken? What are the short- and long-term consequences of each alternative action? What are the desired consequences? The undesired consequences? What consequences do others see?

Weigh in Light of Value System—to the valuing person, each decision is not totally new or isolated. The valuing person has some type of value system, be it simple or complex. Another part of predecision reflection is the job of weighing the attractive options and consequences in light of the values already held by the person. What values do you have that seem relevant and how do you rank them? Does this decision appear to change any values? The order of different values?

Utilize Other Resources—throughout value decision making and action the valuing person uzilizes other resources. Other persons can be helpful and written and organizational resources are also useful. What resources do you have and how can you use them? How can your experience be a resource to you?

Make a Choice: Act on It—at the appropriate point the valuing person makes a choice and then acts on it. This requires the ability to choose from the options and to develop a plan for action. In light of all the predecision reflection and utilization of resources, what is your decision and how are you going to carry it out? What do you need to act?

Relate to Other Persons: Stay Open to Growth—for the valuing person it is important to relate effectively with others and to be open to growth. The individual shares with others to clarify, test and validate personal values. Sharing of values develops a basis for coalition of like-minded valuers for group value development and action. The valuing person has some idea about the image of the future and seeks to grow toward that image of the future. He or she seeks feedback and evaluates that feedback in an effort to grow.[4]

THE VALUES EDUCATOR

Teaching/Environment

WAYS OF WORKING

Establishing a learning contract for a successful learning environment is a key to values education. The following are "Ways of Working" which are most helpful in maintaining that atmosphere.

Accept Others—what students share is what they feel is valuable. The more they feel they will be accepted, the more open and honest they will be. This does not mean that you agree with them. It only means that you respect them and value their rights to share.

Speak for Yourself—if we each speak only for ourselves, then others will be more comfortable in saying what they feel. You are the only person who speaks for you. Avoid the "all," "we," "they" and include the "I."

Avoid Put-Downs—it is very important that we don't put down each other, verbally or non-verbally. Non-acceptance or belittling of self or another person is not helpful. It is a hard rule to follow, but trying to avoid put-downs will help create a positive learning environment.

It's Okay to Pass—you choose not to respond or participate — that's "Okay." Students choose to do this anyway, so why not make it a constructive Way of Working.

Expect Unfinished Business—we are raising issues, not settling them. The idea is to stimulate thinking. Allow for "unfinished business" and you will be creating a constructive teaching environment.

You Are Responsible—each person is responsible for his or her own learning, participation and growth. The instructor can't do it for the student. It is important that you not accept the responsibilities for the student's learning. Only the student can do that.

VALUES EDUCATION TEACHING TIPS

Physical Setting—you are in control of the teaching environment. Choose a situation which is comfortable and allows for movement in the room.

Theme—establish a focus point or theme for each particular class session. It will help tie together some of the loose ends which occur because of the open discussions on values.

Pace—vary the pace from time to time, providing students with an opportunity to write, discuss and physically take stances on values issues.

Directions—give directions to your values methods very carefully. Make the directions as clear and simple as possible. Give all of the directions before starting the strategy. Make sure that everyone in the class clearly understands directions before you start the method.

Participation—participate in the values education methods yourself. Students are interested in what you think and what you believe. But always remain in control of the method itself. You can get thoroughly involved as a participant if you ask someone else to facilitate.

Plan Yet Be Spontaneous—this is not an either/or situation. Be sure to prepare well and plan your lesson, but be comfortable with spontaneity when situation and time demand. Values issues are important to people. The instructor's role will require flexibility.

THE VALUES EDUCATOR:

(SOME OTHER IMPORTANT THINGS THAT WILL HELP)

- Stops to think about values and value decision making in terms of ideal goals presented here.
- Takes time regularly to reflect on his or her own values and tries to live as a model valuing person.
- Decides which value education approach to use beforehand and plans well.
- Meets people where they're at, helps them clarify where they want to go and helps them get there.
- Communicates in ways which allow for questions, provide acceptable answers, clarify further questions and encourage acceptance of the total communication process.
- Answers content questions in a non-committal, okay, all right fashion. It is important as a values educator not to show a particular bias towards a certain issue. Of course you may respond as an individual with an opinion.

BASIC METHODS FOR DOING VALUES EDUCATION

In this section four types of valuing methods are presented:

Methods for Exploring Values—the Get-To-Know Tag, One-to-One and Polling methods are all designed to stimulate thought and exploration of a value area and to provide individuals a chance to share their responses with others.

Methods for Choosing Values—either/or's, Stances and Priorities are all processes which help students practice making choices, taking stands and ordering options for action.

Methods for Focusing on Values—interviews which focus on one person at a time provide an opportunity to share values with the group; the group gets to know one person in greater depth. An entire class can get quite well acquainted in one session.

Methods for Linking Values to Life—vignettes which present a value conflict situation can call on the individual and small group to discover options, consider consequences and plan for action. This practice in linking values to real life situations gives the student a chance to apply classroom learning.

Unfinished sentences may be used to link values to a practical situation. These are methods which share individual reflections and commitments at the end of a discussion.

The above methods are suggested as start-up sequences for ongoing groups of students. They are presented here around basic value issues which are related to the health science field. Please substitute your own content when suitable. You may choose to use these methods in the classroom, in the laboratory, in the clinic, in an extramural setting or with colleagues to help better clarify the values involved in your profession. This part of the chapter will provide you with the "how to's" of value education.

In using any of these methods, it is important that you set the mood and create an atmosphere for valuing. It is crucial that the Ways of Working outlined earlier be presented at the beginning of each class session, that the activities be introduced with enthusiasm and that everything moves comfortably and enjoyably. By starting with the Ways of Working, you are able to refer back to them and reinforce them as the session progresses. Otherwise, you are caught introducing rules one-by-one as problems arise, which makes you the authority figure. Be sure to establish a learning environment conducive to openness and trust. See suggested ideas in the instructors section.

METHODS FOR EXPLORING VALUES

This group of strategies is designed to help the group members focus on themselves and explore their own values in response to carefully selected questions from the instructor. Then each person has a chance to share thoughts and feelings with others.

These are more than just get-to-know methods, if you choose questions of importance and create an environment of serious inquiry.

Get-To-Know Tag

Goals:

1. To get to know each other.
2. To share information important to individuals and the group.
3. To emphasize the importance of listening and sharing.

Process:

1. Give each person a blank notecard -3 x 5 or larger.
2. Ask each person to write in large letters on the card the name he or she would like to be called. (If possible, draw a large Get-To-Know Tag on the chalkboard, writing your directions as you go.)
3. Explain to the class that they are going to list some information about themselves which they can share with one another on a one-to-one basis. Remind them that they can pass if they do not wish to share this information.

EXAMPLE:

In the upper left hand corner of the card, ask them to write one profession in the health sciences (other than the one that they are studying) which they most respect.

In the upper right hand corner of the card, ask them to write the name of one person they most respect in the health science field they are now studying.

In the lower left hand corner of the card, ask them to write several contributions their health care field has provided the world.

In the lower right hand corner of the card, ask them to write three values which are most important to them.

Underneath that have them write the three values which they feel are most inherent in the profession they are seeking.

4. Participants put on their cards and then mill around the room looking at others' cards. Then you may ask each person to pick one other person to get to know better and share their cards with each other.
5. As an instructor, you will want to participate by completing your own card and sharing it with the others.

Other Get-To-Know Questions:

You, as the instructor, will select the questions which will be used in the Get-To-Know Tag. It is important that you know your group, that you consider the profession which they are seeking, and that you select questions which will be consistent with your general purposes in the course. The questions should be open-ended and should elicit information which can be accepted by the group. The Get-To-Know Tag comes at a time when students are getting to know each other and are simply beginning to explore the values inherent in the health science profession which you are teaching.

Here are some examples of other Get-To-Know Tag topics.

- Your greatest success in life.
- Your reason for choosing the profession which you have.
- Several words which would best define you as a person to the rest of the class.
- The forms of communication with which you are most comfortable.
- The sources of your values.
- The major issues you feel are before today's health care delivery teams.
- Several words which describe practitioners in the profession you are seeking.
- Several reasons you selected this school over others.
- Several words that describe what you want to get out of this program.
- Some courses you feel most resourceful in? Least resourceful in?
- Several words which come to your mind when you think of a professional.

The content which is shared on these cards may be used as unfinished business or agenda items to be discussed in another class.

One-To-One

Goals:

1. To get to know each other.
2. To give participants a chance to find out what others in the group think.
3. To practice accepting and clarifying skills.
4. To focus on what one other person thinks.

Process:

1. Have participants form two equal circles—the outer circle facing inward and the inner circle facing out, thus giving you pairs of participants facing each other. It is helpful to the teaching process if the chairs are already arranged in this manner prior to the students' arrival.
2. Ask each participant to discuss the following questions with his orher partner: What are some of your reasons for selecting this health profession? (Be sure to give each pair a chance to introduce themselves to each other.)

   Here are some other topics for discussion:

   - Health Sciences are viewed as a people-helping business. What do you think of this view and how do you plan on helping people in your profession?
   - Continuing education is a part of all health science education today. What is your attitude about continuing education?
   - People are likely to trust you if you trust them. What do you think of this as a reason for trusting people? And what are some other reasons for trusting people?
   - Participating in your professional association is important. Many times it is done because it is expected of you. What do you think of this? What are some ideas you have about professional associations?
   - One reason for developing rapport with the patient is that he will be more receptive to your suggestions. What do you think of this reason, and what are some other reasons for developing rapport with the patient?
   - One reason for using active listening is it helps reduce the patient's anxiety. What do you think of this as a reason, and what are some other reasons for using active listening?
   - One reason for helping patients establish their own needs to do something is that they are more apt to follow through. What do you think of this as a reason, and what are some other reasons for helping patients establish their own needs?
   - One reason for giving patients a choice or involving them in decision making is that they are more apt to follow through. What do you think of this as a reason, and what are some other reasons for giving patients a choice?
   - What are some questions you have about your profession?
   - What are some questions you think are on the mind of the practitioner in the profession you are studying?
   - What do you think is the most pertinent question regarding present day health care delivery systems?
   - What do you want your role to be in the health care delivery team?
   - What kind of patient are you most comfortable with? Least comfortable with?
   - What are some strengths you have that others may not be aware of?
   - What are some values or beliefs you would never give up?
   - What is your greatest hoped-for success in the profession you're pursuing?
   - What qualities do you find most important in a person?
   - What qualities are you most proud of in yourself?
   - Who are some significant people you have known? Tell us about them.

- What are some important issues before your health profession today?

The interaction is two-way even though it is important to focus on one prson's response at a time. Allow 3-4 minutes for discussion. The idea is to initiate discussion, not to resolve issues. Unfinished business will be the norm.

3. Change partners by having the outside circle move two to the left. Give the new partners a new topic for discussion. Repeat until you feel a need to stop or participants have had a chance to share with a significant number of other group members.
4. Another way of using the One-to-One method is to take a particular content topic and design questions which focus directly around the content which is important to cover in that class period. Design the questions so that they provide an opportunity for the student to explore and consider the many different perspectives on this topic.

POLLING

Goals:

1. To help participants explore values openly with a group.
2. To find out quickly where each individual stands on values issues in a way that lets everyone in the group see where everyone else stands.
3. To get acquainted.
4. To provide a way to share value positions quickly without lengthly discussions and thus produce data for later discussions.

Process:

1. Share with the group the objectives of the method. Stress to them that this is a way for them to share information with each other without talking and that they should look around the room to see how others are responding.
2. Ask the group members to raise their hands if they can respond to your questions.
3. Ask several questions as examples so participants can get used to raising their hands in response to your question. Each question should start out with "How many of you." You as an instructor may also choose to raise your hand and thus share information about yourself with the class.

The following are examples of questions to use in polling:

- How many of you have been students for more than 3 years?
- How many of you have recently dreamed of working in a profession entirely different from the one you're studying?
- How many of you agree with the people in your profession on most issues?
- How many of you find your involvement as a student fulfilling?
- How many of you agree with your instructors more often than not?
- How many of you disagree with your instructors more often than not?
- How many of you feel that there are communications problems between people within the profession you are studying?
- How many of you believe that your profession holds the potential for much change in the near future?
- How many of you feel that there are too many health science graduates in your area?
- How many of you feel that the practitioner in your profession is practicing the same kinds of things that you are taught?
- How many of you feel comfortable most of the time not going along with the crowd?
- How many of you think instructors are adequately paid?
- How many of you believe continuing education is an important aspect of being a professional?

- How many of you intend to take an active part in your professional association when you graduate?
- How many of you feel you clearly know the worth of your future profession?
- How many of you would consider working in a rural area upon graduation?
- How many of you selected this profession because of its financial rewards?
- How many of you are from out-of-state?
- How many of you think that the life you have lived thus far has been worthwhile?
- How many of you plan to practice your profession in a state other than the one in which you're going to school?
- How many of you find inconsistencies between the knowledge gained about your health science profession and the attitudes which are apparent in your health science profession?

4. After polling the class on these or any other questions you may have designed, you may want to go back and discuss particular questions in which the class has an interest. Also provide an opportunity for students to come up with their own questions and help them phrase them in a "How many of you" fashion. This is a good way for students to find out about their profession and the attitudes and beliefs that other students in their class have about their profession.

METHODS FOR CHOOSING VALUES

Either/Or

Goals:

1. To help students practice making choices.
2. To help them make a choice.
3. To examine their reasons for the choice.
4. To find out about others' choices and reasons for those choices.

Process:

1. You will ask a question with two alternatives. "Are you more like a physician or a chemist?"
2. After repeating it, you point to the opposite sides of the room and ask those who selected physician to go to one side and those who selected chemist to go to the other. (Be sure they have both alternatives clearly in mind before you give them the order to move.)
3. After they have made a choice, ask who would care to share their reasons for standing where they are on this particular item. Always employ the Ways of Working which encourage an elicitation of information and an acceptance of that information.
4. Call the group to the middle of the room before each Either/Or so that an active choice has to be made each time.
5. After they have made a choice, ask individuals to pair off within their groups and share the reasons for their choices with each other.
6. On another Either/Or alternative, have them select someone who made an opposite choice and share the reasons for their choices with each other.

The following list of Either/Or questions will stimulate students' thinking.

- More like a practitioner or a researcher.
- More like a specialist or a generalist.
- More like a teamworker or an individualist.
- More like a patient or a health care worker.
- More like state or federal regulations.
- More like peer evaluation or agency regulation.

- More like prevention or intervention.
- More like rural or city practice.
- More like a giver or a taker.
- More like a clinician or an educator.
- More like the "old school" or the "new school."
- More like a helper or a watcher.

Stances

Purposes:

1. To help participants look at tough issues and decide where they stand.
2. To provide an opportunity for the participants to share reasons for their own positions on issues.
3. To see where different people stand on the same issue.

Process:

1. Draw a line on the floor or establish a line along one wall with plenty of space for everyone to stand along it. Clearly define the ends and mark the middle point. (No one may stand on the middle point.)
2. Ask a clear question, "Where do you stand on . . . ?" Then describe two extremes at the two ends of the line. Go physically to one end and describe that position. Then go to the other end and describe that position. Try to sound as if you believe in each as you describe it.you believe in each as you describe it.
3. Next, ask that each person take a stand on the line at any point. They are not to talk about it, but simply to go to their places. It may help people get the idea if you frame a question that involves a percentage. For example you might ask, "Where do you stand on the issue of how much time you like to spend alone? Down on this end is the position that it is best to spend no time by yourself. I like to be with other people, all the time. This end is the position that it is best to spend all of my time by myself. I like to be alone all of the time. Now you take a stand. Do you like to spend none of your time alone or 10% or 50% or 75% or 100%?"
4. After each topic provide an opportunity for some kind of discussion. Here are several different ways to do it:
   - "Turn to one person near you and find out why he or she has taken that stand."
   - "Let's hear why some of the people have taken the stand they have taken."
   - "Would anyone at that end like to tell us why you are where you are? Anyone in the next fourth of the line? Any one in this section? Anyone at the other end?"
   - "Let's number off in fives. One, two, three, four, five. One, two, three, four, five, etc. Now if all of the ones will get together and all of the twos, etc. Each group now has a representative of almost every position on each topic. Discuss the issue in your group and listen carefully to each other.

Here are some sample topics.

How important is competition to you?

Absolutely essential to be super-competitive (It's good)	Is not helpful at all to to be competitive (It's bad)

Where do you stand on federal health insurance?

It is important and should be provided for everyone.	It is not important; individuals should be responsible for their own health care

Where do you stand on peer evaluation in your profession?

Peer evaluation by mandate (It's the answer)	No peer evaluation (It's bad)

Where do you stand on these teaching methods?

Self-directed learning (The student is the one who can do it.)	Teacher directed learning (The teacher is the only one who can do it.)

Where do you stand on personal health?

Person who takes care of every personal health detail	Person who could not care less because there are more important things to do in life

Where do you stand on participation in your professional organization?

Complete commitment and dedication to professional organization (No question at all.)	Non-participation in professional organization. Not a viable part of the health care profession I am seeking. (Could never do any good for profession.)

Where do you stand on feedback?

Totally nonaccepting of feedback about my behavior (Never ever.)	Totally accepting of feedback about my behavior. (Anytime, anyplace, always)

Who are the people you trust?

Everyone	No One

How do you react to someone who has different values than you?

Totally accept them	Completely reject them

What about privileges for minorities?

No. Never any special privileges for minorities.	Minorities should always be given special privileges.

PRIORITIES

Goals:

1. To further practice value decision making, this time putting several important values in order of importance.
2. To help participants deal with the toughest choices, those which arise when several alternatives look good but are in conflict with each other.

Process:

1. List three items on a chalkboard.
2. Ask the group to rank these individually, from most important to least. (Have each person rank the items on a piece of paper.)
3. Ask for a show of hands on the ranking of each item and tally those choices on the board.
4. Have small group or total group discussion. Here are ways you might structure that discussion.
   - Form pairs and ask them to discuss the ranking they gave the items.
   - Form small groups of those persons who ranked the same item first. After discussion in these groups have a spokesperson from each group tell the total group why they feel their item most important.
   - Have a total group discussion of observations about the ranking of the issues. This is effective particularly if the group is not too large and if there were good splits on the lists.

Here are some sample lists.

- What would you most like to be in your profession? (Remember, rank all three.)
  Researcher
  Educator
  Practitioner
- Who should have the most knowledge about what a prescription drug does?
  Pharmacist
  Physician
  Patient
- Who does the most harm?
  Unethical practitioner
  Unethical educator
  Unethical student
- Which is the most important to you?
  Being honest
  Being loyal
  Being generous
- Which of these persons do you feel is doing the most harm to his health?
  Person 75 pounds overweight
  Four drinks a night person
  Frequent user of tranquillizers
  Half-a-pack-a-day smoker
- Where are you most likely to seek employment upon graduation?
  Metropolitan area (100m. or more)
  City area (Under 100m.)
  Rural area (Small population—agricultural area)
- Which is most important to you?
  Curing a person yourself
  Helping a patient become more responsible for his own health care
  Other

- A friend of yours has a problem. He would like some help. Which would you have the most difficulty in helping?

  His drunken, alcoholic father
  His mother who has leukemia
  His brother who is on drugs

- Which is most like you?

  Easy
  Critical
  Expect much of others

- List three issues current before health science professions. (Now list them in order of urgency.)
- List three important characteristics of a health care professional. (Now list them in order of importance as characteristic of you.)
- List the three values of most importance to the profession you are studying, and rank them in terms of importance to you.

METHODS FOR FOCUSING ON VALUES

This class method provides the students with an opportunity to focus on one person at a time. Focusing provides the group with a chance to elicit information from each other, accept that information, clarify its meaning through supportive questioning, and then accept again as the participants each speak for themselves.

There are two basic methods in the Methods for Focusing section. One is an interview, which allows for a focus on an individual person in a large group, and the other one is a focus person method, which allows for an individual focus with small group interaction on the topic. This method suggests the importance of personally examining and clarifying for yourself what you believe. Both models increase personal and class awareness on certain topics while emphasizing the importance of self worth of individual students. Being listened to and accepted feels good to all of us.

INTERVIEW

Goals:

1. To focus on one person at a time, providing him or her with the opportunity to share in some depth feelings about a number of issues.
2. To give each person in the group a chance to ask questions and to get to know the group better by listening to the interview and being accepting.
3. To emphasize the importance of taking time to listen to individuals.

Process:

1. Ask the entire group to sit in a circle. Ask for one volunteer to be interviewed. Remind the group of the Ways of Working, emphasizing the right to pass. Also, introduce two new options to the volunteer: "You can say 'enough' if you wish to end the interview at any time for any reason, and you can ask me any two of the same questions I ask you."
2. Interview questions should be open, exploratory, stimulating, yet gentle. The interviewer elicits information and feelings and then accepts the response with a nonjudgmental "okay" or "thank you." Interviews should last five to ten minutes and might include questions such as:
   - What is your full name?
   - Where do you live?
   - How long have you been interested in the health field you are now seeking?
   - What is significant to you about pursuing this particular health science field?
   - What is important to you when you think of your own education?
   - What are some areas you would like to know more about and grow in?

- Who are some significant peole who have affected your life?
- Is there any personal information you would like to share with us?
- Is there anything you would like to share about the profession you are pursuing that I haven't asked you?
- What are some questions you ask yourself often?
- How do you feel you affect other people? -What do you think the future holds for your profession?
- What do you feel your greatest contribution to the health field might be?
- What are some reasons you have for being involved in your profession?

3. Listed here are types of questions which you may want to keep in mind when designing interview questions.
   - Questions about important people.
   - Questions about environment.
   - Questions about skills, values, interests and activities.
4. There are several options for further interviews after the one-to-one interview is concluded. You may choose to interview one or two persons a day in the large group in the same manner or you may suggest that people pair up and interview each other. Interviews are most effective when the interviewer does not use a list of questions, but has some issues in mind and is flexible and a good listener.
5. This method may be used to introduce guest speakers and other helpful resources to the class.
   Some suggestions: A consumer of health services
   A new graduate
   An old health professional ("One who's seen it all") The instructor
   A government official related to the health profession
   Someone from another health science profession

FOCUS PERSON

Goals:

1. To share and to be listened to.
2. To listen when another person is talking.
3. To elicit individual reactions to a definition.
4. To increase feelings of self worth.

Process:

1. Have the participants get into groups of three.
2. Explain that you are going to read a definition of professionalism which the groups will then proceed to handle in the following way:
   a. One person (the focus person) talks about the definition and his or her own beliefs about professionalism for three minutes.
   b. During this time the other group members listen and accept. The listeners may help the focus person say more about the subject by asking occasional clarifying questions. "What makes you think that? Could you share more about what you just said?" The listeners may draw out the focus person but not insert their own views. This is not a group discussion.
   c. Take turns so that each group member has the opportunity to have the focus for 3 minutes.
3. When the groups have finished, ask everyone to forget for a moment the content of the discussion and to focus instead on what happened in the communication. Ask the group as a whole questions such as:
   - How did you feel when you were listened to?
   - How did you feel drawing out the speaker rather than discussing the subject with the speaker?
4. In closing you may want to give the groups time to go back and discuss any unfinished business they may have. Taking time is an important part of focusing strategies.

Other focus person topics:

- What does teamwork mean to you?
- What are the consumer rights in your health science profession?
- What is good human relations in your profession?
- What is your profession all about?
- What are some things that you as students can do to better your profession?
- What are some things you could do if you disagreed with other people in your profession?
- What do you think about this statement by Einstein? "Perfection of means and confusion of goals seem to characterize our age."
- What do you think about this statement by H.L. Mencken? "No man ever went broke underestimating the taste of the American public."
- What do you think about this statement by John Stuart Mill? "A person may cause evil to others not only by his actions, but by his inaction. In either case, he is justly accountable to them for the injury."
- What do you think about this statement by Stewart Steiner? "The past remains bound up in you: it lives in the present and will follow you into the future."
- What do you think about this statement by A.H. Clough? "Thou shalt not kill; but need not strive officiously to keep alive."

METHODS FOR LINKING VALUES TO LIFE

This group of methods is designed to move the focus beyond the explanation of values and the choice between different values to the actions one takes on the basis of one's values. The linking of values to actions is thus life.

Some of these methods call for discussion of possible actions while others involve taking actions and reflecting on how they went. Using these methods with groups can make a significant difference over a time. It is the step beyond safe discussion which can and will make the difference.

VIGNETTES

Goals:

1. To give participants an opportunity to explore options.
2. To give participants an opportunity to consider consequences.
3. To give participants an opportunity to utilize other people in making a decision.
4. To give participants an opportunity to make a decision.

Process:

1. Prepare the group for this by explaining that they will hear a story which poses a problem situation requiring a decision. The story will not have an ending. The ending will be up to the individual listeners.
2. Form small discussion groups of three or four persons and ask them to listen to the story.
3. Read the group a vignette. (Examples can be found following these instructions.)
4. After reading the story, ask each small group to list all of the possible responses to the unanswered question or situation. "What are all the things you could do? Make your group's list as large as possible."
5. After a couple of minutes, ask each group to discuss the consequences of each of their alternatives. "What would likely happen if you did each of the things you've thought up?"
6. After a couple of minutes, ask each individual in each small group to make a decision. Each person chooses one response.
7. Once all have made their choices, have them share and discuss in the small groups reasons for their choices. Each person explains the reasons for his or her choice.
8. Finally, ask for volunteers to tell the total group what their decisions were. You as an instructor do not have to be in every group. Move from group to group and listen, show concern, be supportive of inquiry, ask questions.

Remember in doing vignettes that the ultimate demonstration of action comes when the story is real. One of the points of working with a group of people over a period of time is to be supportive of your group when value decisions are for real. Part of your job as a values educator is to link this discussion to situations real to your class.

Here are some stories that might fit your class:

"The Test"

You are midway through a final examination in your health science course and as you glance up you see several other students cheating on the examination. At the end of the class period the instructor requests that it is for your own good and ethical practice that any information about cheating be turned in to him immediately.

What are all your options?

What are the consequences of each?

Make a choice.

Share your choice and the reasons with the group.

"Higher Education"

You are a student in a classroom. You've paid a lot of money for this education and have taken valuable time to fit this course into your schedule. Two classes into the quarter you find that the instructor is not modeling what he is teaching, and that the class thus far has not been that helpful.

What are all your options?

What are the consequences of each?

Make a choice.

Share your choice and your reasons with the group.

"Moral Decision"

You are a trusted friend of a physician. He tells you: "I have a patient who is in much pain and going to die within the next year. I can keep him alive with several specialized pieces of equipment, but his family is gone, he doesn't have much money and no one seems to be pushing me to do this. What do you think I should do?"

What are all your options?

What are the consequences?

Make a choice.

Share your choice and the reasons with the group.

Groups are generally capable of coming up with their own stories or dilemma situations, so whenever possible give them an opportunity to frame their own vignettes. Limit the situations to those which they might encounter in their chosen profession.

UNFINISHED STATEMENTS

Goals:

1. To provide a time for participant reflection and goal setting.
2. To record participant experiences in the group.
3. To allow students and instructor to experience and share what they have learned.

Process:

1. The instructor asks the students to complete on paper one or more of the following statements:
   I learned that I . . .
   I was surprised that I . . .
   I was pleased that I . . .

2. Ask for volunteers to read aloud or share with the group their finished sentences. Or collect all of the sentences and read them back to the group without identifying who wrote them. This is a good way of helping the instructor keep in touch with what's happening in the class and what's happening to individuals within the class.

   Some other unfinished sentences:

   I would like to learn more about . . .

   As a health professional I need to . . .

   My profession provides me an opportunity to . . .

   I think my patients would perceive my abilities as being . . .

   I perceive my abilities as being . . .

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Footnotes

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Values education as an ongoing methodology utilizes resources and thus models one of its own basic concepts. Use this chapter in a way that is being responsible for your own situation, but most important of all act on it and stay open to future growth and development as a Values Educator.

AN EXPERIMENT IN EDUCATION:
A PATIENT-ORIENTED PHARMACY CURRICULUM

Clayton R. Rowland, AL Albert I. Wertheimer

INTRODUCTION

During the past few years pharmacy curriculum development has greatly broadened its scope while the past decade has seen changes coming so rapidly that the pharmacy curriculum has remained in a constant state of flux. The advent of the clinical component of pharmacy education added a much needed segment to the education of a pharmacist. At the same time another part of the curriculum, pharmacy administration, was expanding its scope. Both of these areas brought to light the need for greater emphasis on the patient and on the affective and behavioral components of pharmacy education.

The purpose of this chapter is to describe in detail one major project designed to focus attention on patient-orientation in pharmacy. It is our intention to illustrate the process of curriculum design and development that evolved in the construction of a holistic approach to pharmacy education. This begins with a brief overview of the project. Following this is a discussion of how a patient-oriented aspect to the curriculum can be developed and evaluated. Finally, the way in which this program relates to and interfaces with competency-based instruction is outlined.

PROGRAM OBJECTIVES

The Social Curriculum Project (SCP) has as its primary goal the development of a series of learning experiences which will provide the pharmacy student with those skills needed to interact successfully with patients and other health professionals in a personal and empathetic fashion. This demands that the pharmacy curriculum present a holistic and interdisciplinary approach to pharmacy education in order to provide the pharmacy student with an appreciation of the patient as person; a person within a milieu that is genetically, environmentally and culturally determined. Thus, the SCP is interested in the affective and behavioral domains as well as the cognitive domain. This presents some problems of testing and evaluation of performance which will be discussed later in this chapter. The specific objectives of the Social Curriculum Project are as follows:

1. Develop a patient-oriented, holistic, problem-solving, interdisciplinary curriculum for pharmaceutical education;

2. Implement this curriculum on an experimental basis;

3. Evaluate this experimental patient-oriented curriculum and compare the results (cross-sectional and longitudinal) to the outcomes of traditional pharmaceutical education;

4. Evaluate student admittance policies (into the College of Pharmacy) as to whether science-oriented or people-oriented aptitudes should be given preference;

5. Demonstrate the interdisciplinary approach of such a curricular model and its possible application to the other health care professions, and

6. Assess high school, community college and community service programs and demonstrate the optional utilization of these programs in relation to the training of health care professionals.

All the above are aimed at training a more competent pharmacist. They are aimed at training a pharmacist who can effectively interact with other health care professionals; with the community and with the patient in order to provide the services needed to promote health.

METHODOLOGICAL CONSIDERATIONS

In order to effectively assess the impact of a patient-oriented curriculum, an experimental design was chosen. This was done for several reasons. The basic philosophy guiding the SCP is that it is not enough that one know that something works, but one must know which elements were successful and how they worked and interact with all variables encountered. Using an experimental design allows one to design a specific treatment or curriculum and then test to see if this curriculum was indeed effective. Also, since the specific treatment is known, the effect can be said to be as a result of the treatment and not an extraneous variable. The experimental design provides control over variables which might have an interactive effect with the main treatment. For example, it was thought that the degree to which a student entering the college was already person-oriented and cared about people would possibly interact with a curriculum designed to foster this approach. In fact, it may well have an effect of its own. It is possible that more science-oriented students would not feel comfortable with a patient-oriented curriculum and would not do as well as if the curriculum were more science-oriented. Using an experimental design allowed this factor to be built-in and thus controlled for in an appropriate fashion. Also, the use of an experimental design allows for control of extraneous and random variables which may have an effect which would not otherwise be detected but would lead to erroneous conclusions.

The above discussion is important because it addresses a very basic issue. The selection of an experimental design in educational research is dependent upon the basic assumptions one uses. When the purpose of a program is to take an idea and make it work, an experimental design may get in the way for it locks-in a particular treatment. If one sets out to make a program more patient-oriented, then the way in which one particular element affects the others may not be important. It is only the results that are of import. But if one wants to know exactly what effect each element of a design has upon the outcome, control becomes a necessity and an experimental design is needed.

The use of an experimental design is not without drawbacks. When dealing with people we are dealing with very complex systems. It is also true that total control cannot be totally achieved. Students interact with each other and with other people. Thus, the use of an experimental design for educational research does not eliminate all factors to the degree that it does in other more exact areas of science. It is the authors' belief that random sampling and a carefully designed treatment outweigh these disadvantages. In any event, this is something that must be decided early in an educational research project.

THE EXPERIMENTAL DESIGN

Having described the rationale for using an experimental design, it seems appropriate to elaborate on the details of the project. A schematic representation of the experimental design is shown in Figure 1.

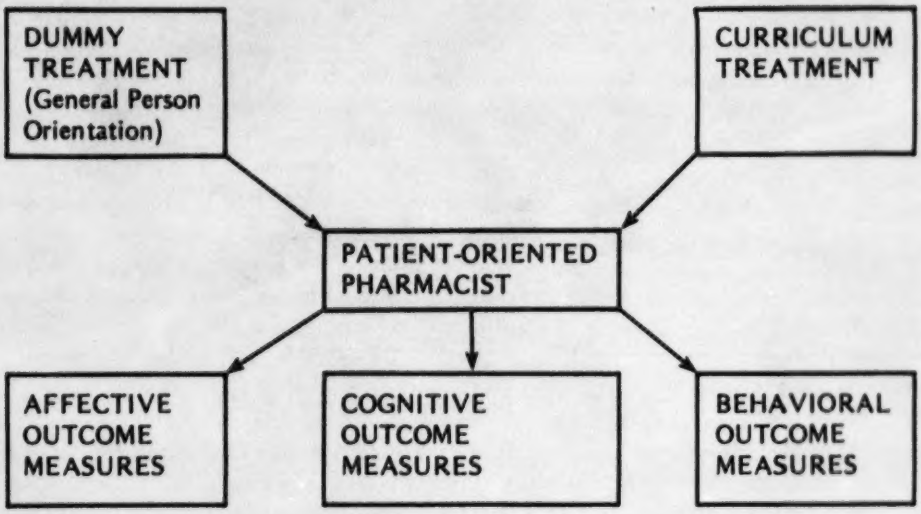

Figure 1. Schematic Representation of Experimental Design

It is the intent of the experiment to give the student a better awareness of the patient and to provide instruction that will enable the student to understand and help his/her patients more effectively as well as to give the student skills needed to interact optimally with other health care professionals. It can be seen from Figure 1 that there is a treatment and a dummy treatment or control group.

The treatment is the experimental educational program designed to accomplish the objectives stated previously and summarized above. The SCP treatment consists primarily of course material in the following areas:

1. Interpersonal communications
2. Values clarification
3. Assertiveness
4. Cross-cultural barriers to communication
5. Pharmacy ethics
6. Drugs and the elderly
7. Death and dying
8. Pharmaceutical anthropology
9. Social marketing
10. Enrichment practices

The last area mentioned above needs some explanation. The basic strategy used by the SCP in its experimental curriculum is one in which the student is exposed to material, given an opportunity to discuss it and

then to practice it in a controlled environment. This is followed by less structured practice in a real environment. Lastly, the student enters externship where there is minimal supervision. The enrichment experiences are designed to accomplish the second phase. They are a series of actual settings where there is a chance to put ma erial and techniques learned into practice in a reasonably controlled environment. Perhaps an example will make this clear. First year students are given training in interpersonal communications. As second year students, they may spend about sixty hours working in a program designed to counsel parents of epileptic children. The third year students work in an actual pharmacy with a pharmacy practitioner who supervises their progress. It should be noted here that the experimental curriculum overlays the standard curriculum. It is different in that it utilizes the electives present in the standard curriculum for the SCP courses. Thus, it is no longer or shorter than the standard curriculum.

The basic educational strategy of the experimental treatment has been alluded to above. Almost all material presented to the students uses a combination of educational methods. There is a lecture or presentation of material followed by discussion of that material. The student then gets a chance to practice via role-playing using video-taping for feedback or other audio-visual presentations are given showing patients under various circumstances. The student then gets a chance to indicate how a particular problem might be solved drawing on the materials and techniques learned. The second phase follows as described above and then the third phase is seen. The third phase is represented by the externship program taken by the third-year students. This consists of an entire academic quarter of working full-time in a pharmacy. Biweekly conferences are held to allow students to give each other feedback and presenting problems encountered. This gives the student the benefit of the instructor's and his/her fellow student's experience with similar problems. All sections are small. Group discussion sections run no more than ten students per group. There is great emphasis then on problem-solving and on practice which is what provides the student with a lasting ability to perform. This is an important point. When one is dealing with skills, didactic presentations are not generally sufficient to provide optimal student learning.

Figure 1 also indicates that a so-called dummy treatment is a part of the experimental design. This arises from the notion that just as the students differ on the amount of chemistry that they know upon entering the College, they also differ on their degree of orientation toward the patient as a person. For example, the pre-pharmacy curriculum is heavily loaded with science courses. This is as it should be but it may attract a student more comfortable with lecture format courses and may make him/her uncomfortable with practice-type courses stressing a knowledge of behavior. Thus a design was chosen which allows for this possible interaction between a patient-oriented curriculum and students with a different degree of patient-orientedness. This design is depicted in Figure 2.

PERSON-ORIENTATION	CURRICULUM	
	SOCIAL	TRADITIONAL
HIGH	I	III
LOW	II	IV

Figure 2. Basic Experimental Design Matrix

This represents an analysis of variance paradigm in which the students were divided into four cells. Students were divided into high and low patient-orientedness and were then randomly assigned to one of two treatment groups – the regular college curriculum or the SCP experimental treatment. The students were divided

into high or low patient-orientedness using a test instrument compiled by the project staff. A new test had to be developed because an extensive review of several psychological tests revealed the following:

1. Person-orientation, as such, does not exist as a test construct. However, there are some dimensions scaled from several different personality inventories which converge on that concept.

2. Appropriate normative data are available for some but not all inventories.

3. In no case was the proportion of variance accounted for by the various test items reported. This precludes our administering abbreviated forms of the tests.

4. In some cases it is possible to administer selective scales and thereby shorten the examination process.

5. The validity of these various scales and their subscales to our purposes is not presently known.

The basis for selection of these tests as well as the basis for curriculum development revolved around the basic definition of a person-oriented practitioner and the behaviors of a patient-oriented pharmacist. These are given below.

The person-oriented practitioner recognizes that the central object in practice is not the treatment itself but the people who are receiving that treatment. Professional decisions are based on consideration of the individual who is treated as a person (rather than as conditions or therapies), and with whom the practitioner interacts in an understanding and sensitive manner. Paramount is the perception of the consumer as an active causal agent who is primarily responsible for and is capable of making judicious decisions and providing for him or herself.

THE BEHAVIORS OF A PATIENT-ORIENTED PHARMACIST

1. Assuring that drug therapy is appropriate and correct for the individual by:
   a. obtaining a concise patient data base to use in making a professional decision;
   b. monitoring ongoing drug therapy, including its effects on a particular patient;
   c. consulting with the physician; and
   d. assuring that the medication dispensed is of adequate quality.

2. Communicating the purpose and potential outcomes of therapy to the patient and providing the patient with adequate information for proper drug use.

3. Advising patients about self-medication and over-the-counter products.

4. Referring patients to physicians or other health care providers and social agencies.

5. Working cooperatively with other health care providers.

6. Educating the general public on health-related matters so that they will seek professional intervention when the need occurs.

7. Providing emergency first aid treatment and poison control information.

8. Basing decisions on patient welfare rather than on fiscal, political, or professional factors whenever there is a conflict.

9. Displaying understanding and empathy in interpersonal interactions with patients.

The optimum measurement scale of person-orientation was designed specifically with the above definitions in mind, then validated on external criteria (social/behavioral) and refined to attain a high degree of interest and test-retest reliability. The best alternative was to choose from instruments already developed to assess similar personal characteristics for which reliability and validity have already been established. The decision was made to locate tests already in use that have conceptual similarity to our objectives and choose specific scales from several, thereby constructing a more appropriate measure. The plan included establishment and refinement of the discriminability, reliability, and validity of this composite instrument with current students in the College of Pharmacy before using it to assign new students to the experimental conditions.

The criteria for test scale selection were:

1. The scale should be linked theoretically to a conceptual construct similar to "person-orientation."

2. The validity and reliability of the instrument should be well established and should be high.

3. Scores on the scale preferably should be positively associated with scores on the service profession scales of the Strong Vocational Inventory (e.g., clinical psychology, social work, and medicine).

4. Scales should be as nearly orthogonal, that is, independent of one another, as possible.

5. The total number of questions in the composite instrument should not exceed 250.

The test instrument developed is known as the General Person-Orientation Profile (GPOP). It consists of five scales generated from over one hundred by a factor analysis. For more information on how the above definitions and the GPOP were developed, see references 1 and 2.

Two pharmacy classes are being used in the study, starting with the class that entered in the fall of 1976. The class that entered the College in the fall of 1977 was the second class to undergo either the social or the control curriculum. Both curricula are to run for the normal three-year period, with classes graduating in 1979 and 1980.

Using two classes is important for two reasons. First, it helps to establish the reliability or the degree of reproducibility of the results. Second, it will allow room for some improvements in the second class's curriculum, based on results obtained with the first class.

EVALUATION

Any experimental design is only as good as the measures used to determine treatment efficacy. Three types of outcome measures are being used on the project. The first is an attitudinal scale. All students in the College will be tested periodically using an attitude test compiled by the staff. This will provide data throughout the project period about student attitudes toward pharmacy practice.

The second outcome measure to be employed in the evaluation is the standard University grading system for measuring academic performance. The student's test scores and course grades will be monitored for each course that they take. Naturally, there will be some cases where the grading system for a particular course may be different from the usual system, and this would require some adjustment to achieve overall standardization. This will provide a cognitive barometer of student performance for each type of curriculum.

The third benchmark deals with a behavioral measure. Because the desired outcome of the curriculum is to produce a patient-oriented practitioner who will indeed practice as such, it is essential that there be a measure designed to determine whether or not a student exhibits patient-oriented behavior. The project staff has developed a series of scenarios that approximate student behavior in practice settings. This along with the other two measures just described, should provide for a complete and thorough evaluation of each curriculum.

In summary, this chapter has described an experiment in education. Using an experimental design, a way of developing and evaluating a patient-oriented pharmacy curriculum has been illustrated.

REFERENCES

1. "Person-Orientation in Pharmacy: Definitions, Concepts and Goals," Social Curriculum Project Working Paper No. 1.

2. "The Generalized Person-Orientation Profile," Social Curriculum Project Working Paper No. 2.

COPYRIGHTING YOUR INSTRUCTIONAL MATERIALS

Yvonne Wulff

The design and use of instructional materials lead quickly to questions about copyright. These questions fall generally into two categories:

– How can copyrighted materials be used for instructional purposes?

– How can instructional materials be copyrighted?

Insight into the question of use sheds some light on the protection offered to copyright holders. This chapter describes briefly sections of the copyright law which are of special interest to educators in both their use and production of instructional materials.

NEW COPYRIGHT LAW

The Copyright Law was revised in 1976 and the new law (PL 94-553) takes effect January 1, 1978. The new law contains several provisions of interest to educators. Among these are three which have implications for the production and/or use of copyrighted works in the classroom. First, the period of copyright protection has been extended. Second, protection is provided for unpublished works. Third, the doctrine of fair use is codified.

- Copyright will extend to the life of the author plus 50 years.
- Unpublished works are protected from the time of their creation. "A work is 'created' when it is fixed in a copy or phonorecord for the first. . ."
- Fair use is defined in Section 107. It provides four criteria for determining ". . .whether the use made of a work in any particular case is a fair use. . ."

USE OF COPYRIGHTED INSTRUCTIONAL MATERIALS

– Books and Periodicals –

The criteria established by the new law do not provide specific or *quantitative limits* against which to measure fair use. They provide only that a decision on whether or not a use of copyrighted material is fair use will be determined by these four considerations:

1. The purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes.
2. the nature of the copyrighted work;
3. the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
4. the effect of the use upon the potential market for or value of the copyrighted work.

In an effort to help educators decide what use if fair use, guidelines for classroom copying were developed by the Ad Hoc Committee of Educational Institutions and Organizations on Copyright Law Revision, The Authors League of America, Inc., and the Association of American Publishers. These guidelines, as printed in the House Judiciary Committee Report (H.R. 94-1476), appear below. One *cautionary note* with respect to these guidelines—they do not have the force of law. Whether they will be acceptable under the law awaits the decision of future court cases. They represent the opinions of one group of publishers, authors and educators on what fair use might mean.

GUIDELINES FOR CLASSROOM COPYING

Agreement on Guidelines for Classroom Copying in Not-for-Profit Educational Institutions With Respect to Books and Periodicals:

The purpose of the following guidelines is to state the *minimum* and *not* the maximum standards of educational fair use under Section 107 of H.R. 2223. The parties agree that the conditions determining the extent of permissible copying for educational purposes may change in the future; that certain types of copying permitted under these guidelines may be permissible under revised guidelines.

Moreover, the following statement of guidelines is not intended to limit the types of copying permitted under the standards of fair use under judicial decision and which are stated in Section 107 of the Copyright Revision Bill. There may be instances in which copying which does not fall within the guidelines stated below may nonetheless be permitted under the criteria of fair use.

GUIDELINES

I. Single copying for teachers:

A *single* copy may be made of any of the following by or for a teacher at his or her individual request for his or her scholarly research or use in teaching or preparation to teach a class:

A. A chapter from a book;
B. An article from a periodical or newspaper;
C. A short story, short essay or short poem, whether or not from a collective work;
D. A chart, graph, diagram, drawing, cartoon or picture from a book, periodical, or newspaper;

II. *Multiple* copies for classroom use:

Multiple copies (not to exceed in any event more than *one* copy per pupil in a course) may be made by or for the teacher giving the course for classroom use of discussion; provided that:

A. The copying meets the tests of brevity and spontaneity as defined below; and,
B. Meets the cumulative effect test as defined below, and
C. Each copy includes a notice of copyright.

Definitions:

Brevity

(i) Poetry: (a) A complete poem if less than 250 words and if printed on not more than two pages or, (b) from a longer poem, an excerpt of not more than 250 words.

(ii) Prose: (a) Either a complete article, story or essay of *less* than 2,500 words, or (b) an excerpt from any prose work of not more than 1,000 words or 10% of the work, whichever is less, but in any event a minimum of 500 words.

(Each of the numerical limits stated in "i" and "ii" above may be expanded to permit the completion of an unfinished line of a poem or of an unfinished prose paragraph.)

(iii) Illustration: One chart, graph, diagram, drawing, cartoon or picture per book or per periodical issue.

(iv) "Special" works: Certain works in poetry, prose or in "poetic prose" which often combine language with illustrations and which are intended sometimes for children and at other times for a more general audience fall short of 2,500 words in their entirety. Paragraph "ii" above notwithstanding such "special works" may not be reproduced in their entirety; however, an excerpt comprising not more than two of the published pages of such special work and containing not more than 10% of the words found in the text thereof, may be reproduced.

Spontaneity

(i) The copying is at the instance and inspiration of the individual teacher, and

(ii) The inspiration and decision to use the work and the moment of its use for maximum teaching effectiveness are so close in time that it would be unreasonable to expect a timely reply to a request for permission.

Cumulative effect

(i) The copying of the material is for only one course in the school in which the copies are made.

(ii) Not more than one short poem, article, story, essay or two excerpts may be copied from the same

author, nor more than three from the same collective work or periodical volume during one class term. (iii) There shall not be more than nine instances of such multiple copying for one course during one class term.

(The limitations states in "ii" and "iii" above shall not apply to current news periodicals and newspapers and current news sections of other periodicals.)

III. Prohibitions as to I and II above:

Notwithstanding any of the above, the following shall be prohibited:

A. Copying shall not be used to create or to replace or substitute for anthologies, compilations or collective works. Such replacement or substitution may occur whether copies of various works or excerpts there from are accumulated or reproduced and used separately.

B. There shall be no copying of or from works intended to be "consumable" in the course of study or of teaching. These include workbooks, exercises, standardized tests and test booklets and answer sheets and like material.

C. Copying shall not:

a. substitute for the purchase of books, publishers' reprints or periodicals;

b. be directed by higher authority;

c. be repeated with respect to the same item by the same teacher from term to term.

D. No charge shall be made to the student beyond the actual cost of the photocopying.

Clarification:

The concept of "teacher" in these guidelines is considered by the House Judiciary Committee to be defined broadly enought "to include instructional specialists working in consultation with actual instructors" according to Subcommittee Chairman Kastenmeier in a speech on the House floor (Congressional Record, Sept. 22, 1976, p. H10875).

USE OF COPYRIGHTED INSTRUCTIONAL MATERIALS

– Audiovisuals –

The new law extends copyright protection to audiovisual works. Duplication and other use of these materials must fall within the scope of the law's provisions. There is no set of guidelines for audiovisual works comparable to that developed for books and periodicals.

If there are no guidelines, how is one to decide whether or not to cut up a film strip and convert the separate images to slides? How do you know whether, from that newly purchased set of slides, you can print a series of photographs in order to illustrate a poster session? There are no simple, straightforward answers to these and similar questions. The most conservative approach to handling such situations (indead, to handling any situation involving the use of copyrighted works) is to write to the copyright holder, explain what you want to do, and ask permission to use the work for that purpose. The copyright holder can respond in several ways. Permission may be granted; it may be denied; or it may be granted upon payment of a fee. If a fee is requested, you will have to decide whether the need warrants the expense. Questions related specifically to the use of protected audiovisual materials may be referred to the Director, Audio-Visual Library Services in Walter Library.

WHO HAS THE RIGHT TO COPYRIGHT

Section 201 of the Copyright Law provides that works made for hire are owned for purposes of copyright be the employer unless ". . . the parties have expressly agreed otherwise in a written instrument

signed by them."

To help clarify the ". . .problems concerning the ownership and use of materials in the development and production of which the University has become an active and intentional partner through the investment of materials and staff," the University of Minnesota has published its *Policy on University Sponsored Educational Materials.* This policy should be reviewed prior to applying for copyright on instructional materials. Requests for copies of that policy and questions concerning it should be directed to the Administrator of University Sponsored Educational Materials, Office of the University Attorney, 332 Morrill Hall.

HOW TO REGISTER COPYRIGHT

The authority on how to copyright works is the Copyright Office at the Library of Congress. The Office publishes an excellent set of easy to read *Circulars* which explain what works are eligible for registration and in which class to make application. The Office also supplies the forms which must be completed for registration. The forms are self explanatory and include information on how to provide the necessary deposit copies of the work. Circulars and forms are available from:

Register of Copyright
Library of Congress
Washington, D.C. 20540

In general, audiovisual works may be registered in one of two ways. Works complete in one format or medium may be registered in the class appropriate to that medium:

Class A – Instructional manuals and other textual materials
Class F – Maps
Class I – Scientific or technical drawings
Class J – Slides, filmstrips, and photographs
Class K – Prints, for example, lithographs
Class N – Sound recordings

Audiovisual works are often published in more than one medium. A self *instructional package* prepared for the use of students may for example, consist of a set of 35mm slides accompanied by a printed syllabus. In this case, the separate parts may be registered individually in their appropriate classes - 35mm slide set in class J and the printed syllabus in class A. In some cases, multi-media programs can be registered "as a unit" in Class A. Circular 49, *Copyright for Audiovisual Material,* describes these options.

– 4 Steps –

– Decide who will hold the copyright on the work you have created.
– Write to the Copyright Office. Describe the kind of material you want to register (book, slide set, multimedia work, etc.) and request the appropriate Circular(s) and registration form(s).
– Complete the form(s) and obtain the required notarization.
– Return the form(s) with the required deposit copies of the work to the Copyright Office.

REFERENCES

The new Copyright Law is unclear in many respects and this introduction highlights only a few of its provisions. The following references will provide a more extensive background into its development and complexity.

1. Holley, Edward G. A librarian looks at the new Copyright Law. Americal Libraries 8:247-251, May 1977.
2. Stedman, John C. Copyright developments in the United States. AAUP bulletin 62:308-319, Oct. 1976.
3. Stedman, John C. The new copyright law: Photocopying for educational use. AAUP Bulletin 63:5-16, Feb. 1977.
4. U.S. Congress Public Law 94-553. An Act for the General Revision of the Copyright Law, Title 17 of the United States Code, and for other purposes.

Application

for Registration of a Claim to Copyright in a published book manufactured in the United States of America

FORM A

REGISTRATION NO.

DO NOT WRITE HERE

CLASS A

Instructions: Make sure that all applicable spaces have been completed before you submit the form. The application must be **SIGNED** at line 10 and the **AFFIDAVIT** (line 11) **must be COMPLETED AND NOTARIZED.** The application should not be submitted until after the date of publication given in line 4, and should state the facts which existed on that date. For further information, see page 4.

Pages 1 and 2 should be typewritten or printed with pen and ink. Pages 3 and 4 should contain exactly the same information as pages 1 and 2, but may be carbon copies. Mail all pages of the application to the Register of Copyrights, Library of Congress, Washington, D.C. 20559, together with 2 copies of the best edition of the work and the registration fee of $6. Make your remittance payable to the Register of Copyrights.

1. Copyright Claimant(s) and Address(es): Give the name(s) and address(es) of the copyright owner(s). Ordinarily the name(s) should be the same as in the notice of copyright on the copies deposited.

Name .....

Address .....

Name .....

Address .....

2. Title: .....
(Give the title of the book as it appears on the title page)

.....

3. Authors: Citizenship and domicile information must be given. Where a work was made for hire, the employer is the author. The citizenship of organizations formed under U.S. Federal or State law should be stated as U.S.A. Authors may be editors, compilers, translators, illustrators, etc., as well as authors of original text. If the copyright claim is based on new matter (see line 5) give requested information about the author of the new matter.

Name ..... Citizenship .....
(Give legal name followed by pseudonym if latter appears on the copies) (Name of country)

Domiciled in U.S.A. Yes ..... No ..... Address .....

Name ..... Citizenship .....
(Give legal name followed by pseudonym if latter appears on the copies) (Name of country)

Domiciled in U.S.A. Yes ..... No ..... Address .....

Name ..... Citizenship .....
(Give legal name followed by pseudonym if latter appears on the copies) (Name of country)

Domiciled in U.S.A. Yes ..... No ..... Address .....

4. Date of Publication of This Edition: Give the complete date when copies of this particular edition were first placed on sale, sold, or publicly distributed. The date when copies were made or printed should not be confused with the date of publication. **NOTE:** The full date (month, day, and year) must be given. For further information, see page 4.

..... (Month) (Day) (Year)

(NOTE: Leave line 5 blank unless the following instructions apply to this work.)

5. New Matter in This Version: If any substantial part of this work has been previously published anywhere, give a brief, general statement of the nature of the new matter published for the first time in this version. New matter may consist of compilation, translation, abridgment, editorial revision, and the like, as well as additional text or pictorial matter.

.....

.....

NOTE: Leave line 6 blank unless there has been a PREVIOUS FOREIGN EDITION in the English language.

6. Book in English Previously Manufactured and Published Abroad: If all or a substantial part of the text of this edition was previously manufactured and published abroad in the English language, complete the following spaces:

Date of first publication of foreign edition ..... (Year)

Was registration for the foreign edition made in the U.S. Copyright Office? Yes ..... No .....

If your answer is "Yes," give registration number .....

EXAMINER

Complete all applicable spaces on next page

7. If registration fee is to be charged to a deposit account established in the Copyright Office, give name of account:

.....

8. Name and address of person or organization to whom correspondence or refund, if any, should be sent:

Name ..... Address .....

9. Send certificate to:

(Type or print name and address)

Name .....

Address .....
(Number and street)

.....
(City) (State) (ZIP code)

10. Certification: (NOTE: Application not acceptable unless signed)

I CERTIFY that the statements made by me in this application are correct to the best of my knowledge.

.....
(Signature of copyright claimant or duly authorized agent)

11. Affidavit (required by law). Instructions: (1) Fill in the blank spaces with special attention to those marked "(X)." (2) Sign the affidavit before an officer authorized to administer oaths within the United States, such as a notary public. (3) Have the officer sign and seal the affidavit and fill in the date of execution.

NOTE: The affidavit must be signed and notarized only *on or after* the date of publication or completion of printing which it states. The affidavit *must* be signed by an individual.

STATE OF .....
} *ss:*
COUNTY OF .....

I, the undersigned, depose and say that I am the

- ☐ Person claiming copyright in the book described in this application;
- ☐ Duly authorized agent of the person or organization claiming copyright in the book described in this application;
- ☐ Printer of the book described in this application.

That the book was published or the printing was completed on: (X) .....
(Give month, day, and year)

That, of the various processes employed in the production of the copies deposited, the setting of the type was performed within the limits of the United States or the making of the plates was performed within the limits of the United States from type set therein; or the lithographic or photoengraving processes used in producing the text were wholly performed within the limits of the United States, and that the printing of the text and the binding (if any) were also performed within the limits of the United States. That such typesetting, platemaking, lithographic or photoengraving process, printing, and binding were performed by the following establishments or individuals at the following addresses:

(GIVE THE NAMES AND ADDRESSES OF THE PERSONS OR ORGANIZATIONS WHO PERFORMED SUCH TYPESETTING OR PLATEMAKING OR LITHOGRAPHIC PROCESS OR PHOTOENGRAVING PROCESS OR PRINTING AND BINDING, ETC.)

Names (X) ..... Addresses (X) .....

....

.....
(Signature of affiant)

(Sign and notarize only on or after date given above)

PLACE NOTARIAL SEAL HERE

Subscribed and sworn to / affirmed before me this .....

day of ....., 19.....

.....
(Signature of notary)

FOR COPYRIGHT OFFICE USE ONLY	
Application and affidavit received	
Two copies received	
Fee received	
Renewal	

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—210—799/2 JUNE 1976—300,000

Certificate

Registration of a Claim to Copyright
in a published book manufactured in the United States of America

FORM A

REGISTRATION NO.

DO NOT WRITE HERE

CLASS A

This Is To Certify that the statements set forth on this certificate have been made a part of the records of the Copyright Office. In witness whereof the seal of the Copyright Office is hereto affixed.

Register of Copyrights
United States of America

1. Copyright Claimant(s) and Address(es):

Name .....

Address .....

Name .....

Address .....

2. Title: .....
(Title of book)

.....

3. Authors:

Name ..... Citizenship .....
(Legal name followed by pseudonym if latter appears on copies) (Name of country)

Domiciled in U.S.A. Yes ..... No ..... Address .....

Name ..... Citizenship .....
(Legal name followed by pseudonym if latter appears on copies) (Name of country)

Domiciled in U.S.A. Yes ..... No ..... Address .....

Name ..... Citizenship .....
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Domiciled in U.S.A. Yes ..... No ..... Address .....

4. Date of Publication of This Edition:

.....
(Month) (Day) (Year)

5. New Matter in This Version:

.....

.....

6. Book in English Previously Manufactured and Published Abroad: If all or a substantial part of the text of this edition was previously manufactured and published abroad in the English language, complete the following spaces:

Date of first publication of foreign edition .....
(Year)

Was registration for the foreign edition made in the U.S. Copyright Office? Yes ..... No .....

If your answer is "Yes," give registration number .....

EXAMINER

Complete all applicable spaces on next page

7. Deposit account:

.....

8. Send correspondence to:

Name ..... Address .....

9. Send certificate to:

(Type or print name and address) Name .....

Address .....

(Number and street)

.....

(City) (State) (ZIP code)

Information concerning copyright in books

When to Use Form A. Form A is appropriate for published books which have been manufactured in the United States.

What Is a "Book"? The term "books" covers not only material published in book form, but also pamphlets, leaflets, cards, and single pages containing text. Books include fiction, nonfiction, poetry, collections, directories, catalogs, and information in tabular form.

Unpublished Books. The law does not provide for registration of "book" material in unpublished form. Unpublished books are protected at common law against unauthorized use prior to publication.

Duration of Copyright. Statutory copyright in published books lasts for 28 years from the date of first publication, and may be renewed for a second 28-year term.

How to secure statutory copyright in a book

First: Produce Copies With Copyright Notice. Produce the work in copies by printing or other means of reproduction. To secure copyright, it is essential that the copies bear a copyright notice in the required form and position, as explained below.

Second: Publish the Work With Copyright Notice. The copyright law defines the "date of publication" as ". . . the earliest date when copies of the first authorized edition were placed on sale, sold, or publicly distributed by the proprietor of the copyright or under his authority, ..."

Third: Register Your Copyright Claim. Promptly after publication, mail to the Register of Copyrights, Library of Congress, Washington, D.C. 20559, two copies of the work as published with notice, an application on Form A, properly completed and notarized, and a fee of $6.

The Copyright Notice. The copyright notice for books shall appear on the title page or verso thereof, and shall consist of three elements: the word "Copyright," the abbreviation, "Copr.," or the symbol ©, accompanied by the name of the copyright owner and the year date of publication. Example: © John Doe 1976. Use of the symbol © may result in securing copyright in countries which are members of the Universal Copyright Convention.

NOTE: It is the act of publication with notice that actually secures copyright protection. If copies are published without the required notice, the right to secure copyright is lost, and cannot be restored.

Books manufactured abroad

In General. Form A is not appropriate for books which have been manufactured outside the United States.

Foreign-Language Books. Applications covering foreign-language books by foreign authors, manufactured abroad, should be submitted on Form A–B Foreign.

English-Language Books. Books in English manufactured abroad may be registered for "ad interim" copyright (Form A–B Ad Interim); or, if they are protected under the Universal Copyright Convention they are eligible for full-term registration on Form A–B Foreign:

(1) *Ad Interim Copyright.* Ad interim registration is necessary for protection in the United States unless copyright has been secured under the Universal Copyright Convention. To secure ad interim copyright a claim must be registered within 6 months of first publication abroad. Ad interim copyright lasts for 5 years or until an American edition is published within the 5-year period and registered.

(2) *Universal Copyright Convention.* An English-language work by a foreign author first published abroad is eligible for full-term U.S. copyright if: (a) its author is a citizen or subject of a country which is a member of the Universal Copyright Convention, or the work was first published in such a country, and (b) all published copies bear the copyright notice provided under the Universal Copyright Convention.

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Fee received	

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